REPORT RESUMES

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COST-BENEFIT MODEL TO EVALUATE EDUCATIONAL PROGRAMS. PROGRESS REPORT.

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DESCRIPTORS- *MODELS, *EDUCATIONAL PROGRAMS, *EDUCATIONAL BENEFITS, *COSTS, *DISADVANTAGED YOUTH, *FEDERAL PROGRAMS,

A PROGRESS REPORT IS GIVEN ON THE DEVELOPMENT OF A FRAMEWORK FOR THE EVALUATION OF EDUCATIONAL PROGRAMS. THE FRAMEWORK WILL BE IN THE FORM OF A MATHEMATICAL MODEL THAT WILL PROVIDE A METHOD FOR THE ANALYSIS OF BENEFITS DERIVED FROM THE ELEMENTARY AND SECONDARY EDUCATION ACT (ESEA), TITLE I PROGRAM. THE MODEL IS BASED ON A CONCEPT OF EDUCATION AS AN INDUSTRY THAT TAKES CHILDREN WITH CERTAIN CHARACTERISTICS AND EMBODIES HUMAN CAPITAL (KNOWLEDGE) IN THEM. FROM THIS CONCEPT, TWO FACTORS WERE IDENTIFIED THAT WERE CONSIDERED TO DETERMINE THE NATURE OF THE EDUCATION PROCESS--(1) THE CHARACTERISTICS OF THE CHILDREN AND (2) THE CHARACTERISTICS OF THE SCHOOL INPUTS. ESEA PROJECTS WERE AIMED AT PROVIDING ADDITIONAL EDUCATIONAL BENEFITS TO DISADVANTAGED CHILDREN, THAT IS, THOSE FROM LOW-INCOME FAMILIES, AND WERE REPORTED TO HAVE THE FOLLOWING EFFECTS--(1) INCREASED THE LEARNING CAPACITY OF THE CHILDREN AND THUS INCREASED THEIR EARNING CAPACITY, AND (2) THE INCREASED LEARNING CAPACITY ALSO INCREASED PROBABILITY OF STAYING IN SCHOOL, INCREASED PROBABILITY OF GRADUATING AND GOING ON TO HIGHER EDUCATION, AND REDUCED THE PROBABILITY OF BECOMING JUVENILE DELINQUENTS. IN THIS STUDY, THE BENEFITS DERIVED FROM THE PROGRAMS WERE ANALYZED IN TERMS OF INCREASE IN PERSONAL INCOME FROM GRADUATING FROM HIGH SCHOOL AND FROM GOING TO COLLEGE, REDUCTION OF UNEMPLOYMENT, REDUCTION OF JUVENILE CRIME, INTERGENERATION EFFECTS, AND INCREASED LABOR FORCE MOBILITY. THE MATHEMATICAL MODEL BEING DEVELOPED WILL PROVIDE A MEANS OF EVALUATING THE MONETARY BENEFITS FROM TITLE I PROGRAMS BY DETERMINING THE MONETARY BENEFITS LESS THE COSTS OF THE PROGRAM. (AL)

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Progress Report

COST-BENEFIT MODEL TO EVALUATE EDUCATIONAL PROGRAMS

Prepared for:

NATIONAL CENTER FOR EDUCATIONAL STATISTICS
U.S. OFFICE OF EDUCATION
DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
WASHINGTON, D.C.

STANFORD RESEARCH INSTITUTE
MENLO PARK, CALIFORNIA

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I FRAMEWORK OF ANALYSIS

Introduction

The purpose of this study is to establish a framework for the evaluation of educational programs. To establish such a framework, it is essential to understand the objectives of the programs to be evaluated, since the success or failure of a program can only be judged against these objectives. Certain objectives can be explicitly stated, defined in narrow terms, and related to a specific program--for example, the objective of increasing knowledge of American history. Other objectives such as the development of civic responsibility pervade the educational system and relate more to the goals of society.[*]

Although comprehensive program evaluation should take into account the whole range of legitimate objectives, or goals, set by society for its educational system, our present state of knowledge precludes consideration of some of the broader, more nebulous goals.[†] This study is concerned with evaluating the success of programs with relation to one set of societal goals--those dealing with economic objectives. The reason for selecting this set of goals is threefold: (1) they are clearly important; (2) they can be translated into terms susceptible to quantitative measurement; and (3) recent work shows that education can contribute to the realization of economic goals.

Edward Denison has estimated that in the United States in the period 1929-56, 42% of the growth in real per capita income can be ascribed to education.[‡] Other works, using Census of Population data, have estimated that individual lifetime earnings are strongly influenced by the amount of education attained.[56,79,160,169,174,175,188]

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[*] 101, p. 47

[†] Some of these goals have been described and analyzed in "Working paper on Goals in Education," December 1964, Committee on Assessing the Progress of Education, established by the Carnegie Corporation.

[‡] 160, p. 35

Education goals should reflect "The complimentary commitment of a free society to equality and excellence."* In the sphere of economic goals, this statement reflects the dual need to attain rapid economic growth, and to alleviate poverty; the latter goal requiring above-average income growth for those in the lower tail of the income distribution curve. Thus, programs such as Headstart and the Elementary and Secondary Education Act have been developed at the federal level to provide additional education for the children of economically deprived families, in the belief that more education will help these children overcome the burdens of a poverty background. If the value of these federal programs in education is to be ascertained and if decisions are to be made with regard to their content and direction, it is essential to determine whether the economic goals of income growth and poverty alleviation are in fact being attained.

Application of Cost-Benefit Analysis to Education

The Principles of Economic Evaluation

Economic evaluation of projects is aimed at measuring the relative desirability of alternative projects in terms of economic criteria so that a rational choice can be made among them. A project may be broadly conceived, such as a program providing additional education to the poor, or narrowly conceived, such as a program to provide additional equipment in science classrooms. In either case, the program represents a marginal change in the education system of the United States and must be evaluated in terms of its marginal contributions to welfare. Much of the economic analysis of education to date is concerned with the average return to education--for example, the value of a high school education is calculated in terms of the average return to all high school graduates. This is satisfactory if the question to be asked is what contribution has education made to the total welfare of the nation; but it is not adequate to answer questions regarding the return to any specific new project in education. For many problems, this creates only small difficulty, because marginal returns may not differ significantly from average returns; but for other projects, the differences may be substantial.

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* 68, p. 40

In one sense, dealing with marginal changes in the education system may be easier than dealing with averages. The social returns to education expenditures clearly include the many non-economic aspects mentioned previously. At this period in time, however, we have universal education, with almost all children attending school, and 71% of those who enter the fifth grade completing high school. Under these conditions, the increases in attainment for some of the most basic societal education goals, such as preservation of democracy, civic responsibility, and social relationships, may be negligible with additional per capita spending on education. Thus, it may be more justifiable to concentrate on economic goals, when considering marginal changes in the education system through new programs, than when considering the average value of the whole system to society.

This premise, although not tested in the current study, supports the decision to concentrate on economic benefits--a decision that is based primarily on the need to limit this first attempt at rigorous analysis of educational programs to those benefits that appear most likely to yield to such analysis. The economic evaluation of a program consists of determining the monetary benefits less the costs of the program. Cost-benefit analysis, discussed below, provides a procedure for making this evaluation.

General Statement of the Cost-Benefit Approach

Cost-benefit analysis has been described as a "practical way of assessing the desirability of projects, where it is important to take a long view (concern for future as well as immediate effects) and a wide view (allowing for side-effects.")[191]

Cost-benefit analysis had application in the United States early in this century in the evaluation of river and harbor projects by the Army Corps of Engineers. The concept was broadened in the New Deal era to justify federal participation in flood-control schemes. The Flood Control Act of 1936 authorized such participation "if the benefits to whomsoever they may accrue are in excess of the estimated costs." In general, cost-benefit analysis is a way of setting out information that needs to be taken into account in making certain economic choices. Essentially, the analytic task is to maximize the present value of all benefits less that of all costs, subject to specified constraints.[191] John Krutilla points out that this procedure does not differ from that of much economic analysis, but that the "desideratum," or objective, and the variables included in the analysis may differ.[178]

A major difference is that the cost-benefit calculus employed by public agencies must take into account the divergence between the private and social costs and benefits, a divergence which can be ignored by the private operator.

Essentially, the justification for using cost-benefit analysis is the failure of the market mechanism to achieve an efficient allocation of resources.[194] This failure may result from the divergence between private and social gains or simply because the enterprise is subject to public control, and pricing is not determined by the market mechanism; such is the case with highway or education services. It is hoped that the application of cost-benefit analysis can improve allocation of resources in these situations and contribute to establishment of the general welfare.

The general principles of cost-benefit analysis would be disclosed by answers to the following questions:[191]

1. Which costs and which benefits are to be included?
2. How are they to be valued?
3. At what interest rate are they to be discounted?
4. What are the relevant constraints?

Since cost-benefit analysis is an economic analysis, the costs and benefits to be included must be those that reflect the economic functions of the system; the benefits must be translatable into money terms, either comprising part of the national income account, or a higher order of social benefit that can be translated into money terms. The costs must represent use of real resources.

The Enumeration of Benefits and Costs of Education

Essentially, education is a process of investment in people, or as stated by economists, a process of creating additions to the value of "human capital." Although the concept of investment implies economic criteria, the payoffs from the investment are likely to be more than simply economic. Weisbrod has identified three types of effects:[203]

1. Those that increase production possibilities. For example, labor skills could be increased by education.
2. Those that reduce costs and thereby make resources available for more constructive uses. For example, education could reduce crime and hence reduce the cost of law enforcement, thereby allowing the resources saved to be used for water supply, civic buildings, etc.
3. Those that contribute to the general welfare. For example, education could lead to a greater appreciation of the democratic system and thereby contribute to political stability.

We may add a fourth type of benefit, which may be termed "consumption benefits," i.e., those that increase an individual's enjoyment of life.

These benefits may be further divided into personal and social benefits, in which the former are those derived by the recipient of the educational inputs, and the latter are those derived by other persons, because of the recipient's education. Two important examples of these are (1) the intergeneration effects of educational attainment on the educational and occupational aspirations of children; and (2) the effects of an educated person on the productivity of others, if these effects are not captured by the educated person in the form of his higher income (a prime example here is teachers).

The purpose of cost-benefit analysis is to permit an evaluation of a project (1) by itself--the sum of the benefits must exceed the sum of the costs; and (2) in relation to other projects--the cost-benefits of one investment are compared with those of another. To accomplish these evaluations, it is necessary that benefits and costs be expressed in the same terms, and that all benefits be reducible to a common denominator so that the sum of benefits from one project can be compared with the sum from others. These objectives are met only by having benefits and costs expressed in money terms, as noted previously. Thus, benefits that cannot be reduced to these terms, such as many of the third type listed above, cannot be included in the analysis. In addition, the present state of knowledge or the present availability of data restricts the number of benefits reducible to money terms. For these reasons, the cost-benefit analysis that can be performed for any education program at this time is at best a partial analysis. One thing is certain--if an education program shows a high positive value (benefits exceeding costs), then the likelihood that the total benefits have not been counted may lead comfortably to the conclusion that the project is worthwhile.*

Personal or private benefits are those that accrue directly to the individual receiving the education and should be equal to the cash payments that the individual (or his family) is willing to make for the education. The social benefits are additional benefits that the individual shares with others. Both kinds of benefits can be further divided into those that are directly reflected in the national income accounts and currently measured in money terms, and those that do not appear in the accounts, but may have a money equivalent (e.g., the consumption benefits to individuals, or the benefits to society of support for democratic institutions).

The benefits to be included in this study are as follows: increase in personal income from graduating high school and from going to college; reduction of unemployment; reduction of juvenile crime; intergeneration effects; and increased labor force mobility.

Cost-Benefit Model for Education

Since the purpose of this study is to develop a cost-benefit model applicable to the analysis of benefits from Title I, ESEA program, it is necessary that the model be relevant to the particular segment of the population affected by the Title I program. The ESEA program is aimed at providing additional educational benefits to the "disadvantaged" children, designated as those from low income families. Essentially, it is America's poverty group that is to be affected by these programs. Thus, in determining benefits, this is the group whose characteristics and potentials must be measured. Although some of the analysis is applicable generally to all groups, there are two major areas requiring special treatment:

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* This conclusion, however, is not wholly defensible. For example, additional education for disadvantaged and discriminated-against persons may have the short run effect of generating dissatisfactions that cannot be fulfilled, thus, leading to frustration, rioting, etc., and thereby diminishing total welfare.

1. The role of discrimination in limiting the private gains from education of certain groups
2. Differences in motivations and aptitudes with regard to educational opportunities

The purpose of this section is to present the general conceptual framework of the analysis. It will be presented as a mathematical model of benefits that we hope to estimate in this report. In spite of the fact that we are primarily concerned here with the conceptual framework, we shall make repeated references to methods of estimation. This is desirable because the methods of estimation will cast light on various aspects of "benefits" that are "social" rather than "private."

From an abstract point of view, we can visualize the "education industry" as one that takes children with certain characteristics and embodies human capital (knowledge) in them. Thus, the two factors determining the nature of this productive process are the characteristics of the children, and the characteristics of the school inputs. A Title I project is expected to influence the educational environment and alter the characteristics of the school inputs. Title I projects in a given school have two main effects:

1. The primary effect of the program is to increase the learning capacity of the children. Since their attainment level is increased, it is argued that they are "more educated." This means that there is more "human capital" embodied in these children, thus increasing their earning capacity.
2. There are secondary effects of this increased learning capacity, and these may be more important. The secondary effects are the increased probability of staying in school, the increased probability of graduating and going on to higher education, and the reduced probability of becoming juvenile delinquents.

The difference between effects 1 and 2 is basic to our approach. Effect 1 could simply be measured in terms of the educational content of the programs and their effectiveness in raising learning capacity; effect 2, however, involves intrinsically uncertain outcome in the sense that the program only changes the probabilities of occurrences of desired events, such as graduation. Thus, our approach calls for estimating the various probabilities involved in the process.

The Basic Structure: Effectiveness

As we have argued above, the effects of Title I projects may be classified into: (1) the primary effect of increasing educational content during the operation of the program; and (2) the secondary effects of the increased learning on the probability of graduating from high school, etc.

With respect to this basic effectiveness equation, any given child has a set of characteristics (k,a,v,r,s). See set of symbols, Table 1. For simplicity, we shall denote a set of characteristics by the letter ϵ so that when we talk about the benefits for a child with certain characteristics, we shall write it $B(\epsilon)$ with the understanding that ϵ stands for an arbitrary set of characteristics. The full notation would be $B(k,a,v,r,s)$.

Primary Effectiveness.* As already stated, during the time when the program is in progress, children learn more and their attainment level is increased. Now let $R(\epsilon)$ be the gross absolute return to education of a child with characteristic ϵ. This would usually be measured by the difference in income between a person with education v and a person with one year less education, v-1:

$$R(\epsilon) \equiv R(k,a,v,r,s) = Y(k,a,v,r,s) - Y(k,a,v-1,r,s)$$

where Y stands for the income potential of a child with the stated characteristics, and where the v term in $R(\epsilon)$ really signifies the additional year of education between v-1 and v.

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* Note that we are using the term "effectiveness equation" rather than "benefits equation" since these equations represent the more fundamental effects of the programs and all other benefits will be computed on the basis of the information provided in the so-called "effectiveness equations."

Table 1

SYMBOLS USED IN COST-BENEFIT MODEL

k = region in which the child is educated

a = age of child

v = schooling in years

r = race

s = sex

Let ϵ = a set (k,a,v,r,s)

B = benefit

Y = income potential; $Y(\epsilon)$ is income potential of a child with ϵ characteristics

R = gross returns to education

$\bar{R}$ = rate of return per year on private capital

T = elapsed time

τ = educational achievement in terms of months of schooling

x_i = set of i school characteristics subject to change by Title i

y_i = set if i child-family characteristics, other than ϵ

P = probability: superscripts (i.e., g,d,j,E) signify the event, and subscripts signify the sub-set of the population affected. Thus, P^E_g is the probability of a high school graduate being employed.

g = high school graduate

d = high school dropout

j = juvenile delinquent or criminal

p = primary effect of Title I

E = employment

C = cost of education

c = college graduate

cd = college dropout

k,g,d,c as subscripts represent a particular characteristic of the affected population; thus $Y_k(\epsilon)$ is income expectation for a member of group ϵ with characteristics (a,v,r,s) in region k

M = mobility

L = years of education of present generation (same as v, and used only in equation measuring intergeneration benefits)

ℓ = years of education of child of present generation

Now, suppose the program lasts T periods. During the T periods of the Title I programs, educational achievement has been increased by a certain educational-equivalence content τ. Hence, during T periods of Title I, the child's level of education is increased by what is equivalent to τ years of schooling. In general, τ is small, since the increase in educational attainment is bound to be equivalent to only a fraction of the elapsed time in the program. Thus, the primary benefits, B_p, of Title I for a given school group, ϵ, may be expressed as follows:

$$B_p(\epsilon) = \tau R(\epsilon) \tag{1}$$

The Probability of Graduation. First, let us distinguish between school characteristics that can be altered by Title I programs and child-family-environment characteristics that cannot.

$x_i \ldots x_m$ = the indicated characteristics of the school

$y_i \ldots y_n$ = the child-family-environment characteristics not affected by the programs

For any child, the probability of his graduating from school when he has the characteristics ϵ can be expressed as:

$$P^g(\epsilon) = \sum_{i=1}^{m} \alpha_i^\epsilon x_i + \sum_{i=1}^{n} a_i^\epsilon y_i \tag{2}$$

This probability function may be different in different regions, at different ages or levels of education, and for different sexes or races.

Since we assume that Title I alters only the school characteristics, then in our analytical framework, a collection of Title I projects means known changes in the x_i variables--i.e., "Title I projects" mean a collection of $(\Delta x_1, \Delta x_2, \ldots . \Delta x_m)$. Naturally, for alternative cost levels, program compositions, and schools, the Δx_i will vary. However, for any given school, such programs are assumed to be known and thus the level of the programs and their composition generate a specific set of values for Δx_i. In its simplest form, the Δx_i may be aggregated into a single variable (Δx_1) representing expenditure per pupil in the program.

It then follows that Title I programs alter the probability of graduating through their alternation of the x_i's such that, if we denote by $\Delta P^g(\epsilon)$ the change in probability of graduation of a child with characteristics ϵ, then

$$\Delta P^g(\epsilon) = \sum_{i=1}^{m} \alpha_i^\epsilon \, \Delta x_i \qquad (3)$$

Equation 3 gives the second basic "effectiveness equation"; all other benefits will be either derived from equation 1 or from the change in probability expressed in equation 3.

The Probability of Juvenile Delinquency. There are two ways of treating the problem of juvenile delinquency. The first approach, which is probably the sounder one, is to apply the same procedure as in the case of graduation. Thus the probability, P^j, of a child with characteristics ϵ becoming a delinquent is expressed as follows:

$$P^j(\epsilon) = \sum_{i-1}^{m} \beta_i^\epsilon \, x_i + \sum_{i=1}^{n} b_i y_i \qquad (4)$$

and the effect of Title I programs is expressed by

$$\Delta P^j(\epsilon) = \sum_{i=1}^{m} \beta_i^\epsilon \, \Delta x_i \qquad (5)$$

Equation 5 gives a third effectiveness equation.

The estimation of equation type 4 is very difficult owing to the absence of appropriate data; an alternative hypothesis, which would be easier to quantify, is to express the probability of being a juvenile delinquent as a function of the probability of being a high school graduate; thus

$$\Delta P^j(\epsilon) = \gamma \Delta P^g(\epsilon) \qquad (6)$$

According to this hypothesis

$$\sum_{i=1}^{m} \beta_i^\epsilon \, \Delta x_i = \gamma \sum_{i=1}^{m} \alpha_i^\epsilon \, \Delta x_i \qquad (6')$$

Clearly, if each coefficient satisfies $\beta_i(\epsilon) = \gamma\alpha(\epsilon)$, then indeed equation 6' is a good hypothesis. However, its assumption--that the change in probability of graduation due to the Title I programs is proportional to the change in the probability of being a juvenile delinquent--leads to a rather simple calculation which requires the estimation of γ only.

From the basic effectiveness equations, we propose to derive all the individual benefits. The next section is devoted to this derivation.

Evaluation of Individual Benefits

As already mentioned, there are two classes of benefits: those that accrue as a primary result of the program, and those that are less certain and that will accrue as secondary effects of the program in the form of altered probabilities of each event occurring.

The primary benefits during the life of the program have been stated in equation 1 above as

$$B_p(\epsilon) = \tau R(\epsilon)$$

The rest of the benefits to be discussed in this section are of the "derived" nature; i.e., derived from the altered probabilities.

Graduation and Its Income Effect.

Recall that $\Delta P^g(\epsilon)$ is the increased probability of graduating. Naturally, "graduating" from high school has a private value over "dropping out," consisting of two effects:

1. A fully employed graduate earns higher income than a fully employed dropout
2. Graduates tend to have a higher probability of being employed.

Now define $\Delta Y(\epsilon)$, the expected increase in income resulting from graduation--compared with the expected income of dropouts:

$$\Delta Y(\epsilon) = \left[Y_g(\epsilon) - Y_d(\epsilon)\right] P_g^E(\epsilon) + Y_g(\epsilon)\left[P_g^E(\epsilon) - P_d^E(\epsilon)\right] \qquad (7)$$

The equation consists of two terms: (1) the employment probability for the graduate times the difference in income potentials, plus (2) the income potential of the graduate times the difference in probability of a graduate and a dropout being employed.

Now suppose that the total cost of education to carry the child from the time the program ends to graduation is $C(\epsilon)$. These funds have an alternative use, the value of which is determined by the rate of return on private capital, $\bar{R}$. Thus, the alternative value of the funds spent on education is $C(\epsilon)\bar{R}$; hence, the total net benefits are

$$\Delta Y(\epsilon) - C(\epsilon)\bar{R}$$

Finally, since Title I projects increase the probability of graduation by $\Delta P^{g}(\epsilon)$, it follows that the expected graduation-income-benefits of Title I are:

$$B_{g}(\epsilon) = \Delta P^{g}(\epsilon) \left[\Delta Y(\epsilon) - C(\epsilon)\bar{R}\right] \tag{8}$$

The College Option Benefits. In order to continue his studies beyond high school, the student must graduate from high school. Thus, graduation yields an additional benefit in the form of an option of continuing studies in college.

Let

$Y_{c}(\epsilon)$ = the income of a college graduate with characteristics ϵ

C_{c} = the investment cost of college studies

$\bar{R}$ = the rate of return on private capital

Then

$$\Delta R_{c} = \left[Y_{c}(\epsilon)\, P^{E}_{c}(\epsilon) - Y_{g}(\epsilon)\, P^{E}_{g}(\epsilon)\right]$$

is the difference between expected earnings of college graduates and those of high school graduates. However, the fact remains that only the net benefits of the option count, so that we calculate

$$\Delta R_{c} - C_{c}\bar{R}$$

as the net benefits of completing college. Now consider the fact that only a fraction, P^{c}, of all eligible high school graduates have the ability and motivation for going to, and completing, college. The option benefits apply only to this fraction. Thus, for the randomly selected individual, the option benefit is worth only

$$P^{c}\left[R_{c} - C_{c}\bar{R}\right]$$

Finally, the change in true benefits of the Title I program would be given by the change in the probability of graduating high school times the college option benefit.

$$B_o(\epsilon) = \Delta P^g(\epsilon) \left[R_c(\epsilon) - C_c\bar{R}\right] P^c(\epsilon) \qquad (9)$$

One can enrich this discussion by considering the option of going to college as really being composed of two parts: one is the option of having some college (with return R_{cd} and cost C_{cd}) plus the option of completing college (analyzed above). Then we have the following: Let $P^{cd}(\epsilon)$ be the proportion of high school graduates that continue their studies in college but do not complete it. The expected option benefit of this is

$$\Delta P^g(\epsilon) \left[R_{cd}(\epsilon) - C_{cd}\bar{R}\right] P^{cd}(\epsilon)$$

Recalling that P^c is the probability of going to college and graduating, we finally have the total college option benefits

$$B_o(\epsilon) = \Delta P^g(\epsilon) \left[R_c(\epsilon) - C_cR\right] P^{cd}_{(\epsilon)} + \Delta P^g(\epsilon) \left[R_{cd}(\epsilon) - C_{cd}R\right] P^c(\epsilon) \qquad (10)$$

Mobility Benefits. The probability that an individual will move from one region of the country to another may depend upon many factors. Thus if P_{AB} is the probability of mobility from A to B and P_{BA} is the probability of mobility from B to A, then if the two regions are the same economically, geographically, and socially, we should expect $P_{AB} = P_{BA}$. This means that there will always be some "mobility noise" between any two regions purely because of changing tastes, varying economic conditions, etc. But if there are distinctive differences between regions, then $P_{AB} \neq P_{BA}$. It is generally assumed that the existence of net immigration between regions reflects differential economic opportunity.

If all factors of production, including labor, were perfectly mobile, one would expect all factors to receive the same return (adjusted for transport cost) in all regions. But this is not the case, since mobility is not perfect. Thus, if education in some way can increase the willingness and ability to move, then educated individuals will be more capable *of taking advantage of greater benefits available outside the regions in which they reside.*

Since Title I programs are available to children in different regions, some of them may attain the additional benefits because of their greater capacity to move to more rewarding areas.

Now consider an individual in group ϵ. Assuming his income expectations in his region of origin, k, is $P^E Y(k,a,v,r,s)$, we define

$$\left(\bar{P}^E_{\bar{k}}\bar{Y}_{\bar{k}}\right)(a,v,r,s) = \max_k \left[(P^E Y(k,a,v,r,x)\right]$$

That is, there is a region in which his income prospects are maximum, and his additional income due to mobility is:

$$\bar{P}^E_{\bar{k}}\bar{Y}_{\bar{k}}(a,v,r,s) - P^E Y(k,a,v,r,s) \equiv \bar{P}^E_{\bar{k}}\bar{Y}_{\bar{k}}(\epsilon) - P^E Y(\epsilon)$$

If the region for maximum income is the region of present domicile, then the expected increase in income because of mobility is zero.

If an increase in education because of Title I changes the probability of mobility for an individual in class ϵ by $\Delta P^M(\epsilon)$, then the total expected benefits from increased mobility are

$$B_M(\epsilon) = \Delta P^M(\epsilon) \left[\bar{P}^E_{\bar{k}}\bar{Y}_{\bar{k}}(\epsilon) - P^E Y(\epsilon)\right] \tag{11}$$

Naturally, there is one step missing in this discussion and this is the association between $\Delta P^M(\epsilon)$ and Title I projects.

This association can be established in two steps: (1) we do know that a T period Title I program is equivalent to τ years of schooling, and hence the direct effect is $\tau\Delta\hat{P}^M(\epsilon)$, where $\Delta\hat{P}^M(\epsilon)$ is the change in probability due to one year of schooling; (2) since, however, $\Delta\hat{P}_M(\epsilon)$ is only an approximation, consider the difference

$$P^M_g(\epsilon) - P^M_d(\epsilon)$$

as being the difference in probability of mobility between an individual in group ϵ who graduates high school and one who does not. Title I can affect mobility by changing the probability of being a graduate. Thus, the mobility increase due to Title I is given as:

$$\Delta P^g(\epsilon)\left[P_g^M(\epsilon) - P_d^M(\epsilon)\right]$$

Thus the total increase $\Delta P^M(\epsilon)$ is

$$\Delta P^M(\epsilon) = \tau\Delta\hat{P}^M(\epsilon) + \Delta P^g(\epsilon)\left[P_g^M(\epsilon) - P_d^M(\epsilon)\right] \tag{11a}$$

The Benefits of Reducing Juvenile Delinquency. We have seen earlier that from the effectiveness equations, we can compute $\Delta P^j(\epsilon)$--i.e., the change in the probability that a child of group ϵ will become a juvenile delinquent. Hence, it is only necessary to translate this change in probability to the benefits that may be yielded by it.

Now supposing that we consider the income stream of a child in group ϵ under two separate conditions: (1) assuming that he is a juvenile delinquent, and (2) assuming that he is not. Let $Y_j^t(\epsilon)$ be the income at time t of a child of group ϵ who becomes a juvenile delinquent, and let $Y^t(\epsilon)$ be the income at time t of the same child if he is not a juvenile delinquent. Then the difference in income stream of a juvenile delinquent and a nondelinquent is:

$$A_j(\epsilon) = \sum_{t=o}^{n} \frac{Y_j^t(\epsilon) - Y^t(\epsilon)}{(1 + r)^t} \tag{12}$$

where A_j is the measured present value of the change of private income that is due to becoming a juvenile delinquent. Since $\Delta P^j(\epsilon)$ is a negative number with respect to Title I effects and we would expect $A_j(\epsilon)$ to be a negative number, the private benefits, $\Delta P^j(\epsilon)\ A_j(\epsilon)$ would be positive.

However, in the case of juvenile delinquency, we can extend "benefits" to include some social benefits. Let $C_j(\epsilon)$ be the present social cost of juvenile crime, including the direct costs of protection, apprehension, adjudication, and incarceration, plus the social effects of the crime itself, including personal and property damages and psychic losses. Then society will expect to save $C_j(\epsilon) - \Delta P^j(\epsilon)$because of the decreased probability of juvenile delinquency. Thus total benefits would be

$$B_j(\epsilon) = \Delta P^j(\epsilon)\left[A_j(\epsilon) - C_j(\epsilon)\right] \tag{13}$$

Intergeneration Benefits. Intergeneration benefits are those that accrue to the offspring of the generation presently being educated. These benefits result from the association between the education attainment of parents and their children. It has been estimated, for example, that the child of a parent who had only elementary school education can be expected to have 2.6 fewer years of education than a child of a parent who was a college graduate.[199] Thus, one benefit of increasing the education of the present generation is the higher educational attainment that can be expected from future generations without any additional programs for that generation.

We may assume that additional education will mean as much to the future generation as it means to the present generation, except that it will occur at a later point in time. Thus, we have the following representation of the benefits to be derived by the future generation:

$$B_f(\epsilon) = f'B(\epsilon)\,\frac{1}{(1+d)^n} \tag{14}$$

where B_f is the benefit to the future generation; f' is the change in the next generation's educational attainment resulting from a change in one year in the educational attainment of the present generation; $\frac{1}{(1+d)^n}$ is the discounting necessary to shift the stream of benefits for the next generation to the present, in which the year "n" represents the number of elapsed years before the benefits are expected to start accruing.

The personal benefits to the present generation can be expected to be some fraction, λ, of the benefits derived by the next generation; but there is no simple way of estimating λ. The question to be answered in determining the value of λ is, "What is the rate of substitution between our income and that of our son? The answer will vary significantly between individuals, since each person values the benefits to his children differently.

It seems that most parents are willing to pay a great deal for their children's education, so that we can assume that λ is large. In equilibrium, the son would spend on education an amount equal to his expected discounted lifetime earnings; thus, we could estimate λ as the proportion of the cost of the son's education that the parent is willing to pay. That is, if we could conduct an experiment to find out what is the maximum amount that individuals are willing to pay for the education of their children, and then if we compare this amount with the actual cost of education, we would get an estimate of λ.

Thus, the benefits to the present generation from the induced increase in the next generation's education is given by the following

$$B_I(\epsilon) = \lambda B_f(\epsilon) \tag{15}$$

~~However, Title I programs only increase the probability of this event. Thus the contribution of Title I is~~

$$\Delta P^g(\epsilon)\, \Delta \ell(\epsilon) = \Delta P^g(\epsilon)\, f'\Big(L(\epsilon)\Big)\, G(\epsilon) \qquad (16)$$

~~The expected increase in the offspring's education because of Title I is measured by this expression. Naturally, the benefits spread over all the benefits we have discussed above: benefits from increased income, option benefits, mobility benefits, etc.~~

~~The simplest procedure for treating this problem is as follows. Define by B(ε) the total benefits to the individual in group ε. By definition, we have~~

$$B(\epsilon) = B_p(\epsilon) + B_g(\epsilon) + B_c(\epsilon) + B_M(\epsilon) + B_j(\epsilon) \qquad (17)$$

~~as the total benefits from Title I projects during our generation's lifetime. Since every dollar of benefits is proportional to the level of education for the group ε, it follows immediately that the total benefits to the next generation are nothing but~~

$$f'\Big(L(\epsilon)\Big)B(\epsilon)$$

~~Hence the total intergeneration benefits to our generation become~~

$$B_G(\epsilon) = \lambda f'\Big(L(\epsilon)\Big)B(\epsilon) \qquad (18)$$

Potential Benefits, Actual Benefits, and Social Benefits

In our developments above, we have used the difference, say, $Y_g(\epsilon)-Y_d(\epsilon)$, very often. This difference was argued to be the measure of the expected increase in income of a dropout in group ε, if he graduates. The difficulty that this measure creates is related to our basic distinction between private and social benefits. Thus the difference $Y_g(\epsilon) - Y_d(\epsilon)$ is indeed the expected increase in earnings of this individual. But note that if this individual is a Negro who is being discriminated against, this difference does not measure the true level of social benefits since it is most likely that the productivity level of a Negro is equal to that of a white man with the same education although his income is less; hence, the difference in earnings between the Negro and the white performing the same task is transferred either to corporate profits or to consumer surplus. Thus, the presence of this discrimination means that for the same occupation and level of education, the white worker's salary is a better measurement of the Negro worker's productivity than the Negro worker's salary. Because of these considerations, we have estimated additional social benefits for all ϵ groups of Negroes on the basis of their white workers' equivalent salaries. Discrimination that results in Negroes performing tasks typically performed by whites with less education represents a reduction in total benefits below the amount potentially available. This reduction in benefits will be taken into account in calculating total benefits by adjusting the expected benefits from educating Negroes for the differences in the occupational distribution of whites and Negroes at each level of education.

A similar problem has arisen in the estimation of social benefits to women. A large number of women in the labor force work only part time by choice, and many women do not enter the labor force--e.g., are housewives. The benefits imputed to women's education on the basis of their rate of participation in the labor force are understated. The actual benefits of education to women not in the labor force, or to women working part time, are greater than their earnings, since they usually have the option of working full time. The failure to exercise this option means that the nonmonetary benefits of raising children, running a household, or participating in other social activities are greater than the benefits of the foregone income.*

Thus, the benefits of high school graduation for all women, regardless of whether they work full time or part time or do not work at all (out of their own choice), are to be computed as the difference $Y_g(\epsilon) - Y_d(\epsilon)$ for fully employed women in the ϵ category. Although this procedure may still underestimate the true benefits that accrue to the female population, it provides an estimate of the social value of a housewife's services as being equal to the opportunity cost of her labor.

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* The term "option" is used here in the broad social sense of alternative permitted by the operation of the market. It does not mean that every individual has an effective option at every point in time. For example, a housewife with six children gave up her option to work at an earlier time.

Total Benefits

In the discussion above, we have analyzed the different types of benefits that accrue to each individual in each group (k,a,v,r,s). In order to obtain the total benefits of the program, we have to add up the benefits over individuals in each group participating in Title I programs and the benefits over groups.

The benefits from education occur in the form of a stream over time. To calculate total benefits, it is necessary to compute the present value of this stream. The discussion of estimation procedures will be continued in Chapter IV.

III THE EFFECTS OF TITLE I ON EDUCATIONAL ACHIEVEMENT AND GRADE ATTAINMENT

Introduction

Even prior to Title I, public attention had become focused on the high school dropout problem as one of the most critical to be solved. Despite the decline in the dropout rate in the U.S., dropout is a severe problem because of the dearth of job opportunities for persons with less than a high school education. For this reason, the probability of completing high school is a critical element in our cost-benefit model.

We have considerable information on the personal, social, and family characteristics of the dropout, and will use this information in estimating how Title I can be expected to improve the probability of graduating from high school. In frequency of dropout, Negroes have outnumbered whites by almost two to one, according to studies conducted in large cities.[107] There are strong indications at the national level that schools have greater holding power for girls than for boys.[52,104,105] When tested psychologically, dropouts were found to rank lower in terms of social adjustment as defined by the test.[61] The incidence of dropout seems to have been more closely associated with large families when there are five or more siblings.[70] A broken home has some apparent effect upon dropout since more dropouts than graduates have come from broken homes.[97,128] Parent's occupation is significantly correlated with the child's ability to finish school, as is IQ rating.[125]

Despite high correlation between IQ test scores and graduation, substantial numbers are dropping out who possess sufficient capability to complete high school; many of these students even possess the potential capability for college.[52,98,102,133]

In general, the factor most closely associated with dropping out is grade level retardation--that is, being below modal grade for the age group or achieving at less than grade level.[52,61,122,137]

Attempts to alleviate the dropout problem have led to the establishment of dropout prevention programs and work-study programs. Prominent among these have been the programs instituted in large cities such as Kansas City, Missouri,[134] St. Louis,[126] and New York City.[136] Large scale compensatory education programs for raising the scholastic achievement of children from low income families have been begun in many cities throughout the country. The Higher Horizons Program in New York City is a large scale effort that has been well documented.[135]

Title I has arrived on the scene in the midst of efforts to grapple with the dropout problem. The magnitude of the monies and efforts devoted to the Title I program bids fair to dwarf most of the best efforts devoted to dropout prevention. The avowed purpose of the program is to improve the quality of education for the "disadvantaged." However, all connected with this program can discern that Title I eventually should appreciably reduce the rate of dropout if it is to be judged a success. At this moment, however, Title I could have little immediate effect on dropout. Most programs did not get under way until the spring of 1966, and few district programs focused on keeping the potential dropout in school. Also, most of the Title I budget has been devoted to the lower grade levels which can affect the dropout rate only in the future.

In order to understand the dimensions of the dropout problem as well as to determine how it may be entered into the cost-benefit model, we have undertaken a preliminary survey of representative dropout studies. Our primary interest was to determine whether previous action programs have succeeded in reducing the dropout rate in specific localities. If we failed to find any such reduction, this would discourage us from expecting too much from Title I.

The failure of Title I or its predecessors to significantly reduce the dropout rate might indicate the dominance of nonschool factors which are outside the influence of these programs. In reviewing the characteristics of the dropout, we have arrived at the hypothesis that there is probably a hard core dropout group which cannot be affected by a program such as Title I. This group consists of those who simply must leave school for the purpose of providing family support, and others who lack the ability to meet educational requirements for high school graduation. But aside from this hard core, most of the group can be salvaged by the Title I program.

Incidence of Dropout at the National Level

The national dropout rate has been decreasing over time, as demonstrated in Table 2, which gives school retention rates (the converse of dropout). Classes followed from the fifth grade to graduation are revealing an increasing number of graduates per 1,000 students. The graduating class of 1965 had a retention rate double that of the first recorded class in 1924--710 per 1,000 against 302 per 1,000 in 1924. A retention rate over 70% still leaves the numbers of dropouts at 650,000 in 1965, and above 600,000 in every year since 1950.[29]

To estimate the magnitude of the future dropout problem, the trend in high school graduation has been extrapolated beyond 1965. Figure 1 presents this extrapolation. The sharp rise in retention in 1965 has been taken into account but the trend beyond that year has been based on the less steep rise between 1960 and 1964. According to this trend, the class of 1974 will retain 790 students per 1,000, with a dropout rate of 21%; the class of 1979 will retain 820 students per 1,000, with a dropout rate of 18%; and finally, the class of 1984 will retain 840 students per 1,000, with a dropout rate of 16%--only half the present rate. These may be conservative estimates since we have leveled off from the sharp rise in 1965, rather than taking the latter as indicative of the beginning of a new trend.

In view of the primary emphasis that Title I programs place on students of low economic groups, projection of the future expected dropout rate for this group should be examined separately from overall national rates. Dentler and Warshauer have developed data on dropouts from low socioeconomic groups, for 1940 and 1960, and projected these to the year 1980.[69] They adopt the rationale that the dropout rate will decrease in proportion to the declining number of economically impoverished households. According to their projections, the probability of both being in low economic class and dropping out decline from 0.40 in 1940 to 0.25 in 1960, to 0.15 in 1980.* Furthermore, the probability of graduating for the low income group

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* Reference 69, p. 7.

Table 2

RETENTION RATES OF FIFTH GRADERS TO COLLEGE ENTRANCE

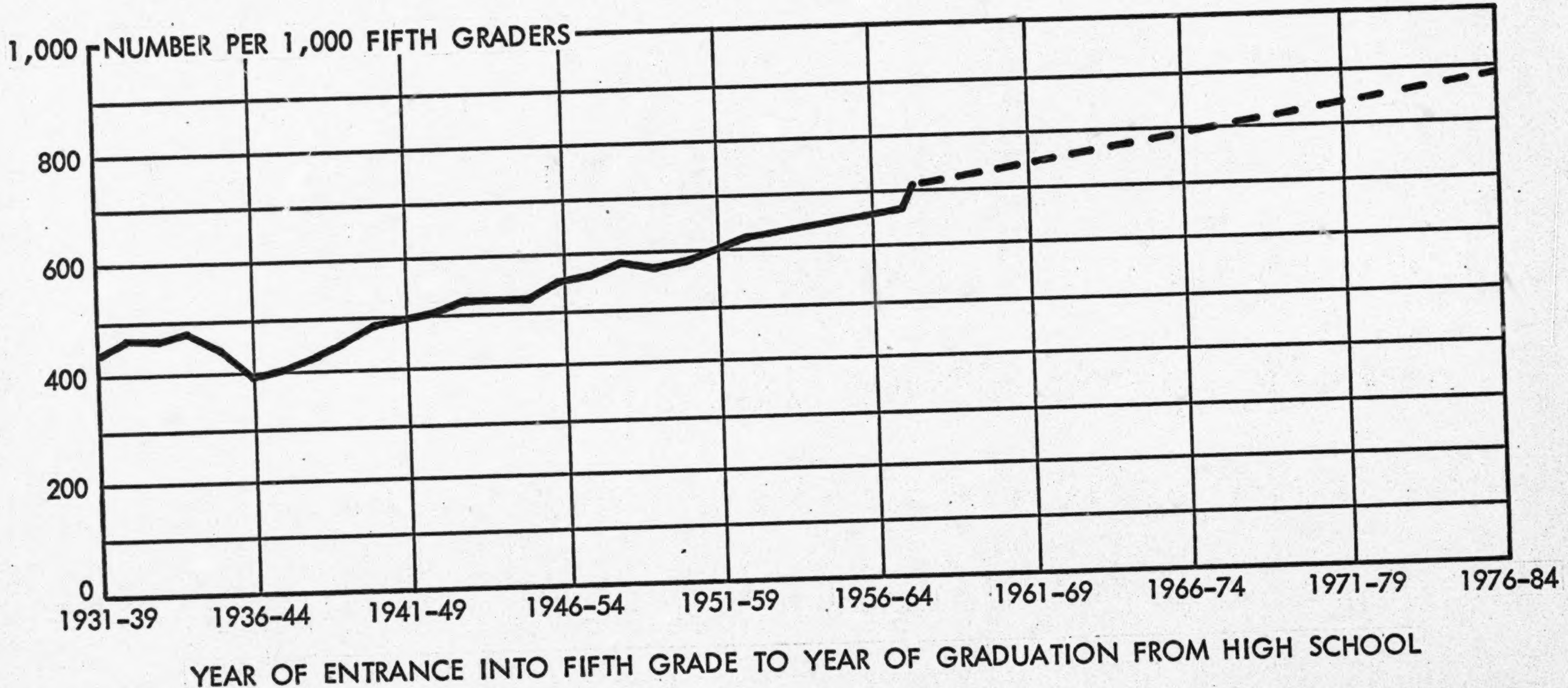
Year of Entrance into Fifth Grade	Retention Rate by Grade per 1,000 Pupils Who Entered Fifth Grade									Year of Gradua-tion	First-time College Students
	Fifth	Sixth	Seventh	Eighth	Ninth	Tenth	Eleventh	Twelfth	High School Graduates		
1924	1,000	911	798	741	612	470	384	344	302	1932	118
1926	1,000	919	824	854	677	552	453	400	333	1934	129
1928	1,000	939	847	805	736	624	498	432	378	1936	137
1930	1,000	943	872	824	770	652	529	463	417	1938	148
1932	1,000	935	889	831	786	664	570	510	455	1940	160
1934	1,000	953	892	842	803	711	610	512	467	1942	129
1936	1,000	954	895	849	839	704	554	425	393	1944	121
1938	1,000	955	908	853	796	655	532	444	419	1946	*
1940	1,000	968	910	836	781	697	566	507	481	1948	*
1942	1,000	954	909	847	807	713	604	539	505	1950	205
1944	1,000	952	929	858	848	748	650	549	522	1952	234
1946	1,000	954	945	919	872	775	641	583	553	1954	283
1948	1,000	984	956	929	863	795	706	619	581	1956	301
1950	1,000	981	968	921	886	809	709	632	582	1958	308
1952	1,000	974	965	936	904	835	746	667	621	1960	328
1954	1,000	980	979	948	915	855	759	684	642	1962	343
1956 (p)	1,000	985	984	948	930	871	785	724	667	1964	357
1957 (p)	1,000	994	985	954	937	878	810	758	710	1965	378

Sources: U.S. Department of Health, Education and Welfare, Office of Education: Biennial Survey of Education in the United States, Chapter 1, Statistical Summary of Education. Digest of Educational Statistics, annual.

* Lack of detailed information regarding veteran students makes the calculation of retention rates unreliable.

FIGURE 1

RETENTION RATES OF FIFTH GRADERS TO HIGH SCHOOL GRADUATION



SOURCE: U.S. Department of Health, Education, and Welfare; Office of Education; Biennial Survey of Education in the United States, Ch. 1, Statistical Summary of Education, Digest of Educational Statistics, annuals; Projections by Stanford Research Institute.

improves from 0.33 in 1940, to 0.38 in 1960, to 0.50 in 1980. These projections must, of course, be taken cautiously, since all projections are subject to error.

Probability of Graduation and Dropout as a Function of IQ Scores

Although most dropouts tend to come from the lower intelligence levels, there are many dropouts that score relatively high. Table 3 presents intelligence test result levels for a sample of approximately 11,000 students from five areas in which over 7,000 were graduates and the remainder were dropouts.[52]

Using P_D = DO/Total within each intelligence test level as an index of probability of dropout, it can be seen that scores on these tests do have an interactive effect on dropout. The probability of dropout with above-average scores (110+) is only 0.18, whereas when the IQ score falls below 85, the dropout probability increases to 0.64. The overall dropout rate is 0.36, which is close to the nationally estimated average of 0.33. Generally, the trend is one of increasing probability of graduation with increases in test scores. A person scoring 110 and above would have twice the chance of completing high school, compared with the chance of those scoring at 85 or below.[*]

The calculation of median IQs for both groups has revealed the following results:

	Median
Graduates	98.84
Dropouts	91.40

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[*] A chi-square test of the data in Table 3 shows that the relation between graduation and IQ scores is statistically significant at the 10% level:

$$X^2 = 606.87, \text{ significant at } P < 0.01.$$

As an index of association between IQ score, as it is grouped in Table 3, and graduation/dropout, the coefficient of contingency (C) has been derived from our chi-square. C is equal to 0.22, which is significant for the large sample in this study. This means that 22% of the variation in dropout is statistically explained by the variation in IQ score.

Table 3

IQ RATINGS OF GRADUATES AND DROPOUTS IN FIVE AREAS

IQ	Graduates (G)	Dropouts (D)	Total (G + D)	P_G	P_D
110+	1,186	256	1,442	0.82	0.18
90-109	4,489	1,945	6,434	0.70	0.30
85-89	784	601	1,475	0.57	0.43
85	702	1,230	1,432	0.36	0.64
	7,161	4,032	11,193	0.64	0.36

$X^2 = 606.87$ ($P < 0.01$)

C (Contingency Coefficient) = 0.23

P_G = Possibility of graduation

P_D = Possibility of dropout

Source: U.S. Department of Labor, BLS, School and Early Employment of Youth, Bulletin No. 1277, August 1960, Table 3, p. 14 (reference 52).

The median for graduates is close to the standardized national average. The median of 91.40 for dropouts is of interest since it indicates that half the sample of dropouts score above 90 IQ, which is a popular approximation to the lower limit of IQ associated with successful completion of high school. (According to Table 3, 80% of the graduates score 90 or above.)

In a study by Wolfle, covering over a million students entering the ninth grade in 1949, it was found that 34% of students dropping out measured at 98 and above in IQ tests.[133] This group comprises some 160,000 students, including 20,000 who scored over 118 and who were definitely suited for completing college successfully.

Using the Wolfle data, we found a 0.40 correlation between IQ rating and graduation/dropout, which means that IQ rating statistically explains 16% of the variance involved in high school completion. Data on the distribution of IQ in the Philadelphia School Systems confirmed the finding that the probability of a student with a high IQ score dropping out is very low, while the reverse is true for a student with a low IQ score.[107] * See Table 4.

The studies reviewed indicate that very substantial numbers of dropouts make low IQ scores; nevertheless, we find that about one-third of those leaving high school prior to graduation have above-average IQ ratings and at least one-half rate sufficiently high to complete high school.

It is very likely that many of the high numbers of dropouts having above-average IQ scores have had to leave school because of hardship factors but many others have not been properly motivated in school, and thus may be remotivated by a program that would keep them from dropping out. Actually, we would hope that Title I would succeed in retaining potential dropouts throughout the entire student population.

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* The trend for the Philadelphia data is not precisely similar to the results of the Seven Areas study[52] since different IQ tests were used and the distribution has been split differently.

Table 4

GRADUATION AND DROPOUT BY IQ LEVEL IN PHILADELPHIA SCHOOLS - LONGITUDINAL

(Study of 1500 Students Entering First Grade in 1949)

IQ Levels	% Graduating	% Dropouts
Q_1	91	9
Q_2	79	21
Q_3	73	27
Q_4	40	60
Total	73%	27%

Graduates	750
Dropouts	270
Others	480
Total	1500

Source: Educational Survey Report for the Philadelphia Board of Public Education, Board of Public Education School District of Philadelphia, Philadelphia, Pa., February 1, 1965 William R. Odell, Survey Director and The Survey Staff, Table 4, p. 41.

Socioeconomic and Cultural Factors in the Dropout Problem

The dropout problem is not one that pervades all levels of our society. Table 5 shows, for youths 20 to 24 years of age (an age at which all should be out of high school), that for white males and females, the graduation rate is 75% while for Negroes it is slightly under 50%. In analyzing the dropout problem in Quincy, Illinois, Bowman found that 47% of dropouts and only 20% of stay-ins were from the lowest of four social classes.* Using the father's occupation to indicate socioeconomic class, Thomas[125] found the highest percentage (88%) of his graduates have parents in white collar occupations (see Table 6). The lowest graduation rate (65%) is associated with children of parents who are laborers and factory workers. These differences were found to be statistically significant ($X^2 = 12.35$, $P < 0.02$), thus permitting us to conclude that there is an interaction between occupation of parent and the probability of graduating.

The usual limitation to the number of variables which may be examined in a single study can be overcome by the use of multiple regression analysis. Using such an approach, Dentler and Warshauer[69] have obtained dropout data on 131 of the largest cities in the United States and have established a multiple prediction of the dropout rate from socioeconomic characteristics. Their prediction has been estimated separately for white and nonwhite dropout rates.

Through regression analysis, a multiple correlation of $R = 0.87$ between socioeconomic characteristics and dropout rate for white students was established. Table 7 presents major sources of variance for variables represented in the Multiple R. These data suggest that a high white dropout rate is associated with low incomes combined with parental characteristics adverse to education, i.e., being in blue collar jobs and having a low level of literacy. These findings are consistent with those of the Coleman report, which found that a large percentage of the variances in

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* Reference 61, Table 7, p. 24.

Table 5

THE PROPORTIONS OF HIGH SCHOOL GRADUATES AND DROPOUTS IN THE TOTAL YOUTH POPULATION OF 20 TO 24 YEARS OF AGE

March 1965

White	High School Graduates	Dropout	Negro	High School Graduates	Dropout
Male	75.6%	24.4%	Male	49.4%	50.6%
Female	77.0	23.0	Female	48.3	51.7
Total	76.3%	23.7%		48.7%	51.3%

Source: Population Characteristics Educational Attainment March 1966 and 1965. Series P-20, No. 158, December 19, 1966, Bureau of the Census, U.S. Department of Commerce.

Table 6

SOCIOECONOMIC LEVELS, REPRESENTED BY OCCUPATIONAL GROUPINGS AND INCIDENCE OF GRADUATION AND DROPOUT

	Graduation		Dropout		
Parent's Occupation	No.	%	No.	%	Total
1. Laborers, general factory workers	59	65	32	35	91
2. Machinists, welders, electricians, carpenters	69	73	26	27	95
3. Policemen, firemen, foremen, superintendents, bus drivers	57	76	18	24	75
4. Proprietors, salesmen, clerks, general office	60	83	12	17	72
5. White collar, bankers, draftsmen, artists, (college not necessary); also engineers, lawyers, teachers, executives (college necessary)	43	88	6	12	49
	288	75	94	25	382

Chi-square = 12.35 ($P < 0.02$)

Source: Thomas, Robert Jay, "An Empirical Study of High School Related Dropout in Regard to Ten Possibly Related Factors," Journal of Education Soc., Vol. 28, September 1954 (reference 200).

Table 7

INDEPENDENT COMPONENTS OF WHITE DROPOUT REGRESSION AND THEIR CONTRIBUTIONS TO TOTAL PREDICTED VARIANCE

Independent Components of Regression	Contributions		
	Beta	Zero Order r	Percent Relative Contribution to Total Predicted Variance
Percent in white collar occupations	-0.3093	-0.53	16%
Percent white income under $1,000	0.3119	0.52	16
White adult illiteracy rate	0.1922	0.51	10
Percent occupied units with 1.01+ per room	0.2363	0.39	9
Percent white income between $1,000-$1,999	0.2159	0.39	8
Percent population under 5 years	0.4086	0.16	7
Percent increase in population 1950-1960	-0.1890	-0.30	6
Nonwhite dropout rate	0.1167	0.41	5

Multiple R = 0.87 $R^2 = 0.77$

Source: Dentler, Robert A. and Mary Ellen Warshauer, Big City Dropouts, Center for Urban Education, New York, 1965, Table 2-1, p. 17.

the school performance is attributable to factors external to the school.[25]* In the Dentler and Warshauer study, 77% of the variance in the dependent variable was accounted for by approximately eight socioeconomic variables.

For nonwhites, Dentler and Warshauer found a multiple correlation of R = 0.67 between socioeconomic characteristics and the dropout rate. The most meaningful combination of variables is represented by the six variables in Table 8. The six variables in Table 8 succeeded in accounting for 45% of the variance in the dependent variable. The highest correlation (0.41) stems from the relationship between the white dropout rate and the nonwhite dropout rate. Almost 20% of the variance in nonwhite dropout rate is accounted for by variation in the white dropout rate. This implies that performance of nonwhites is dependent on performance of the dominant white community in the area.

The Potential for Changing Dropout Rates Through Educational Programs

Reasons for Withdrawal From School

Interviews with individuals who are dropouts can give some indications for determining how many potential dropouts could be encouraged by the school system to remain. For example, the finding of a lack of interest in school work might be typical of dropouts scoring above-average in IQ tests. The high desirability of keeping these IQ types from dropping out might then require changes in the school system or pattern so as to arouse their interest.

A more accurate determination of how Title I affects dropout rates must, of course, be deferred to the future. We shall have the answer when students, exposed to several years of Title I programs, reach the legal age for leaving school. At present, we have the results of several large scale studies, using interview techniques to determine the reasons for dropping out. In one study, school records were searched to determine whether the reasons given to school authorities for dropout were the same as those

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* See later section for discussion of the Coleman report, and other cross-sectional analyses.

Table 8

INDEPENDENT COMPONENTS OF NONWHITE DROPOUT REGRESSION AND THEIR CONTRIBUTIONS TO TOTAL PREDICTED VARIANCE

Independent Components of Regression	Contributions		
	Beta	Zero Order r	Percent Relative Contribution to Total Predicted Variance
White dropout rate	0.4651	0.41	19
Percent nonwhite male operatives	0.2308	0.33	8
Nonwhite adult illiteracy rate	0.3138	0.20	6
Percent nonwhite-non-negro 1960	-0.2318	-0.27	6
Percent nonwhite income $10,000 or more	-0.2805	-0.16	4
Nonworker ratio	-0.2056	-0.19	4

Multiple R = 0.67 $R^2 = 0.45$

Source: Dentler, Robert A. and Mary Ellen Warshauer, op. cit., Table 2-3, p. 19.

given in personal interviews long after leaving school.[52] The results are compared in Table 9.

According to school records, only 24% of the males left school because of adverse school circumstances. In the interview group, however, 38% indicated that school had been an unpleasant place for them.

Further, several of the reasons given were clearly masks for other responses. This is obviously true of the answer "reached age 16." Thus, we would suggest that not less than 44% of the male dropouts and 35% of the female dropouts left because of adverse school experience or poor motivation from the school environment. Adverse school experience also was found By Woollatt[209] to have been a leading factor in school withdrawal, in his study of 840 dropouts in New York State.

The most important task is to identify the potential dropout while he is still in school. It has been demonstrated that below-normal achievement and retardation in grade are key indicators of the potential dropout.

School Achievement of the Dropout

The performance of the dropout in school decreases much earlier than his point of formal withdrawal would indicate. Such signposts have even led those studying the dropout problem to recommend indices for dropout-prone students, so that appropriate authorities may give them remedial programs early in their educational experience rather than attempt to cope with the problem when it is too late. An example of how early achievement begins to suffer in those who eventually drop out is presented from the study conducted in Quincy, Illinois by Bowman and Matthews.[61] They compared dropouts and two stay-in control groups--one for IQ rating and the other for social status. The California Reading Achievement Test was used to test students in the first and fourth grades. See Table 10. At the first grade level, no significant differences in achievement occur between the dropouts and their two control groups. (We have used the 0.05 level of confidence as our cut-off for significance; X^2 of 4.93 fails to reach that level.) By the fourth grade, however, statistically significant

Table 9

REASONS FOR LEAVING SCHOOL DERIVED FROM SCHOOL RECORDS AND INTERVIEWS

	School Records			Interviews		
Reasons for Leaving	Male	Female	All	Male	Female	All
Adverse school experience	24%	20%	22%	38%	32%	35%
Work	22	13	18	25	12	18
Reached age 16	18	15	17	6	4	5
Military service	14	--	--	6	--	--
Health	4	9	5	5	7	6
Moved within area	4	5	5	--	--	--
Marriage	1	21	--	3	27	--
Adverse home circumstances	3	5	4	7	9	8
Other	10	12	11	10	9	10
Number of dropouts	4,268	3,354	7,622	749	810	1,559

Source: Reference 52. Table 7, p. 19. Table 8, p. 20.

Table 10

DROPOUTS COMPARED WITH CONTROL GROUPS IN READING ACHIEVEMENT

Level of Reading Achievement	First Grade			Fourth Grade			Seventh Grade		
		Controls			Controls			Controls	
	Dropout	IQ	Social	Dropout	IQ	Social	Dropout	IQ	Social
At or above grade level	40%	50%	53%	56%	67%	73%	20%	36%	53%
Below grade level	60	50	47	44	33	27	80	64	47
Total percent	100%	100%	100%	100%	100%	100%	100%	100%	100%
Total no.	138	110	101	138	110	101	138	110	101

Chi-square = 4.93, $P < 0.10$ level of confidence (not significant; $P < 0.05$ level requires $X^2 = 5.99$ for 2 degrees of freedom)

Source: Reference 61, page 38.

differences are occurring among the three groups. (The chi-square is now significant at 2% level: $X^2 = 8.31, P < 0.02$.) Thus, by the fourth grade, six years before most dropping-out occurs, the potential dropout is already performing below the school standard in reading achievement compared with those of equal IQ rating and equal social standing. By the seventh grade, the potential dropout is easily identified, since 80% of them are below grade level in achievement. Because most students do not leave school until they attain the given legal age limit, there is opportunity to identify potential dropouts as those who are becoming retarded in achievement levels. It would appear that a major task of Title I is to change achievement and thereby increase the probability of a pupil graduating from high school.

Grade Retardation and the Dropout

A somewhat less satisfactory (although more readily available) measure of achievement retardation is grade retardation, representing the count of all students who are over modal age for their grade level. This measure ignores the relationship between IQ score and its given achievement standards--a relationship that may reveal whether or not a student is meeting the standard for his IQ; it also ignores the influence of school policy with regard to grade retardation. But, using age against grade is a convenient criterion, as has been attested to by its use in several studies.

In a comprehensive study on dropouts, previously discussed, it was found that 58% of the male dropouts and 42% of the female dropouts were retarded two years or more.* See Table 11. The students at the modal grade expected of them have approximately a sixfold greater chance of graduating than those retarded two or more years. Losses still occur among those at grade level but they are minimal when compared to the large

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* On the basis of another study, it may be estimated that the average rate of retardation for those retarded two or more years is 2-1/2 years. See Syracuse University Youth Development Center, "The School Dropout Problem," Syracuse, 1963, Table 6, p. 14.

Table 11

GRADE RETARDATION AND PROBABILITY OF GRADUATION

Grade Level	Males				Females				Total			
	Graduates	Dropouts	P_G	P_D	Graduates	Dropouts	P_G	P_D	Graduates	Dropouts	P_G	P_D
Behind 2 years or more	437	3,197	0.12	0.88	275	1,778	0.13	0.87	712	4,975	0.13	0.87
Behind 1 year	1,365	1,517	.47	.53	1,102	1,453	.43	.57	2,467	2,970	.45	.55
At modal grade	3,658	704	.84	.16	5,508	807	.87	.13	9,166	1,511	.86	.14
Total	5,460	5,418	0.50	0.50	6,885	4,038	0.63	0.37	12,345	9,456	0.57	0.43
	10,878 (all males)				10,923 (all females)				21,801 (combined)			

$X^2 = 8496.80$ ($P < 0.01$)

$C = 0.53$ (contingency coefficient)

P_G = Probability of graduation.

P_D = Probability of dropout

Source: U.S. Department of Labor (BLS), "School and Early Employment Experience of Youth," Bulletin No. 1277, August 1960, Chart 3, p. 5, Table 1, p. 11, Table 2, p. 12.

number of students leaving without a diploma because of retarded status.[*] Many other students show a high correlation between being a dropout and being retarded in grade at time of dropping out.

Effectiveness of Compensatory Education Programs Prior to Title I

The educational programs we are now witnessing under Title I are not without precedence in earlier programs for the low income groups. Although the true effects of Title I will not be known until it has continued for several years, the outcomes of earlier programs may permit us to anticipate these results. We have selected a limited number of projects to study, choosing those similar to Title I because of their target populations and their avowed objectives. Also, we have restricted our search to those projects which have employed matched groups or which have compared their results against historical baseline data for comparable student groups. In addition, some cross-sectional studies provide normative results for the effects of different inputs upon student achievement.[†]

The Relation of School Inputs to Pupil Achievement--Cross-Sectional Analyses

Several recent studies have analyzed a cross-section of schools by use of multiple correlation to determine the extent to which differences among schools in average pupil achievement are accounted for by differences in school inputs.

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[*] Through visual inspection of Table 11, it is quite apparent that grade retardation is strongly associated with the probability of dropout. Nevertheless, we have submitted the combined data on graduates and dropouts to a chi-square test, not only to confirm what appears in the data but also to determine an approximation to the correlation of levels of grade retardation to a graduate/dropout split. The magnitude of our derived chi-square ($X^2 = 8496.80$, $P < 0.01$) allows us to reject the hypothesis of no differences in grade attained between our graduates and dropouts. The derived C (contingency coefficient) is estimated at 0.53. For the sample of 22,000 students, grade-level performance succeeds in accounting for approximately 2% of the variance implied in the graduation/dropout split. These are considered to be conservative estimates since a C of 0.53 is restricted from the attainment of unity because of categorized data. A corrected estimate of this C would probably be above 0.60.

[†] Compare references 104, 107, 145, and 147.

Their efforts have not been very rewarding. In the first place, the intrapersonal factors so dominate performance that no outside factors can be expected to have very large effects on the differences in scores. It has been estimated that more than 75% of the variance in scores on an ability test represented differences among individuals within a school, and only about 25% represented differences in the average scores between schools.[25] Thus, at the outset, there is only a small portion of variance in test scores that can be explained by school inputs. Further, when we take into account that schools differ because of the different socioeconomic makeup of the student body, because of regional variations and urban-rural differences, and that all these differences affect pupil performance, there is little explanatory power left for school input variables. Perhaps, one should be encouraged if cross-sectional analysis shows any variation in performance due to school inputs.

Other factors also enter to weaken the prospects that cross-sectional analysis will disclose information on the relationship of school inputs to outputs. There is a strong tendency for schools within districts and for districts within states to spend similar amounts per pupil and to provide similar services.[*] In fact, a large proportion of states have state aid programs that tend to equalize the per pupil expenditures of districts within the state. Thus, within states, the range of variation in expenditures per pupil is small. The absence of wide variations in expenditures per pupil between school districts weakens the use of cross-sectional analysis designed to capture the effect of spending on achievement. Lastly, it must be remembered that the cross-sectional analysis does not provide a direct answer to the relevant question regarding effect. The cross-sectional analysis shows how differences in inputs among schools are related to differences in pupil performance, which is only a surrogate measure of how additional inputs in a given school can be expected to change performance. Yet despite limitations, the cross-sectional analyses do give some indications of the relationship between educational inputs and outputs. The results of certain major studies are discussed below.

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[*] In a study of school districts in California, it was found that regardless of the sources of funds or arrival of extraneous influences, such as a military base, districts in California tended, over time, to approach the state average in spending per pupil by adjusting local effort. (See Spiegelman, R., et al,, "Entitlements for Federally Affected School Districts Under Public Laws 874 and 815, SRI," May 1965 pp. 116-76.

Equality of Educational Opportunity Report

The report on Equality of Educational Opportunity, hereafter referred to as the Coleman Report, is the most comprehensive, covering a stratified random sample of nearly 600,000 pupils from about 4,000 schools. The intent of the study was to determine the factors that most account for differences in achievement of white and nonwhite pupils in the public school system of the United States. The findings of this report are generally not encouraging for those expecting to be able to improve school achievement through increasing inputs in the education system.

The first finding is that variation in achievement is highly individual, as indicated by the fact that only a small percent of the total variation in achievement is represented by achievement differences between schools; but that what differences do exist are greater for Negro children than for white children.[*]

By comparing the percent of total variance in individual verbal achievement scores between schools for the first grade and subsequent grades, the report concluded that school inputs are probably not a very important cause of the variance. The authors reasoned that differences in the first grade represent mainly factors brought from the home, and that school influences should enter more strongly as the child moves through the grades. They found, however, that for whites, the percent of variance between schools was no greater in grades beyond grade 1 than it was in grade 1.

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[*] For verbal ability, the percent of variation between schools was as follows:

Negroes		
	North	15.5%
	South	21.6
Whites		
	North	9.8
	South	11.8

Source: Coleman Report (reference 25), Table 3.21.1, p. 293.

For Negro pupils, the percent of variance did increase between grades 1 and 3, but declined back to the differences of grade 1 thereafter; thus, it is possible to conclude that the school makes almost no difference in student performance on verbal achievement scores.[*]

To the extent that there are between-school differences in individual achievement, these differences appear to be more closely related to factors that may be termed "student body quality," than to school inputs.[†] After controlling for individual backgrounds, the Coleman Report found that for Negro children, about 70% of the between-school differences in the South and 50% in the North were accounted for by this factor. For whites, the proportions were about 75% in both North and South.[‡]

The question of integration was studied in depth by the report, but the results are inconclusive. Negro pupils did perform better in schools with substantial proportions of white students. However, the effects of integration were mainly related to quality characteristics of the student body other than race. Further, the effects of race became very weak when school characteristics were entered first in the regression. Only 3% of the variance for Negro pupils is explained by the percent white in the school when other aspects of student body background and per pupil expenditures in the school are controlled.[§]

In examining the influence of school input factors, the report concluded that by far the most important factor was the characteristics of the teachers, including their level of education, experience, preferences for teaching middle class white children, race, localism, and intelligence. After controlling for pupil backgrounds, it was found that teacher characteristics accounted for a sizable proportion of the between-school variation, and that the percent accounted for increased with grade--a result that encourages the conclusion that this is a causal factor and not a spurious correlation.[*] The report also found that the influence was much greater on the minority pupils than on the white pupils.

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[*] Reference 25, Table 3.22.1, p. 296.

[†] Ibid, Tables 3.23.1, p. 303 and 3.23.2, p. 306. Student body characteristics are: proportion whose families own encyclopedias, number of student transfers, attendance, proportion planning to attend college, teacher's perception of student body quality, and average hours of homework.

[‡] Ibid., p. 307

[§] Ibid., Table 3.23.4, p. 310.

In general, the conclusion of the report is that the performance of white pupils was overwhelmingly determined by their background and motivations, while the performance of minority children was much more influenced by the school. These influences, however, were mainly the result of the characteristics and motivations of other students and teachers, and not very much related to school expenditures and facilities. Unfortunately, the very high degree of intercorrelation[†] of all the causal factors makes it impossible to state a definitive conclusion about either integration or school inputs. If all other factors are controlled, no factor makes much difference because some of the effects of that factor are buried in the controlled factors. Thus, controlling for family background weakens the effect of school expenditures, because the characteristics of families in the community are related to expenditures on schools, in terms of both ability to pay and motivation.

Project TALENT

Project TALENT is a major study jointly undertaken by the American Institute of Research and the University of Pittsburgh under the auspices of the U.S. Office of Education to study the American high school and high school student on a longitudinal basis. This study is designed to evaluate how the schools are influencing the achievement and aspirations of these students, both while in school and after. For part of this study, the relationships between pupil achievements, as measured by results in ability and achievement tests, were compared with school inputs.[‡]

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[*] Reference 25, Table 3.25.1, p. 317.

[†] The intercorrelation matrixes have not yet been made available from the Coleman Report. However, evidence from the Project TALENT data, which is reviewed later, shows high intercorrelation of community characteristics (related to family background) and school inputs. For example, median family income and per pupil expenditures have a bivariate correlation of 0.54. See Project TALENT, CRP 226, Table 9-3.

[‡] Other aspects of Project TALENT will be covered in other sections of this report, especially those dealing with the probability of dropout.

Dividing schools by community type so as to control for rural-urban, city size, regional, and family income differences, the investigations found that school inputs, as measured by per pupil expenditures, had a strong relationship to achievement scores in certain groups, but not in others.

The relationships were as follows:*

Community Type	Relationship of Achievement Scores to Expenditures per Pupil
1. Large cities (over 1-1/2 million population)	
a. With generally low incomes	Quite strong
b. With generally moderate or high incomes	Positive but less strong
2. Moderate sized cities (250,000 to 1-1/2 million)	Very weak (negligible)
3. Cities below 250,000 in northwest section of United States	Very strong
4. Western cities with low incomes	Strong
5. Southeastern cities with moderate incomes	Strong
6. Western small towns	Strong
7. Most of southeastern and western cities regardless of population	Very weak

Where strong, the per pupil expenditure explained between 10% and 50% of the variance in individual scores. But these correlations did not correct for individual family background, or for any of the school environmental factors discussed in the Coleman Report.

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* Reference 114, Tables 6-34 to 6-37.

A further analysis using stepwise multiple regression showed that a combination of school and community characteristics explains a large proportion of individual test score differences; but the high degree of intercorrelation of the independent variables makes it difficult to interpret the meaning of the individual effects. For example, for large cities, the various characteristics explain almost 60% of the score variances; but the single, most significant variable is the percent of parents in the PTA (probably a surrogate for parent interest), and the second most significant variable was having study halls in the school, which would not commend itself as a likely causal factor.* More likely, the use of study halls is a negative influence, since it often accompanies overcrowding and substitutes for content courses.

In the multiple regression work, expenditures per pupil turn out to be a weak variable compared with other measures of school and community inputs, indicating that combinations of variables more specifically related to pupil performance are much better than the single aggregate of all school inputs as represented by expenditures. One such combination that would be better would include: starting salary of teachers; size of mathematics and science classes; number of teachers with M.A. degrees; number of books in the library; age of school buildings; and existence of a guidance program.

The finding of Project TALENT that school variables are more important in categorized cities emphasizing low incomes is consistent with the Coleman Report finding that minority pupils respond more to school inputs than white pupils. This finding is further strengthened in a study of pupil achievement in California.

Other Cross-Sectional Studies of Pupil Achievement

In a California study, it was found that teacher quality (as represented by certification and salary) was the most important school factor in the performance of pupils in school districts from the lowest third of the socioeconomic scale. Teacher quality, instructional expenditures, and class size were important factors in improved scores for pupils in the highest third of the socioeconomic scale, whereas school variables were generally insignificant factors for the middle third. The authors of the study could throw little light on the reasons for the differential performance of these groups.*

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* Reference 114, Tables 9-23 to 9-25.

In a study of achievement variations in New York school districts, it was found that expenditures per pupil were a significant factor for the larger districts (those with more than 2,000 pupils), but not for smaller districts.[94] In this study, it was estimated that for the larger districts, an additional expenditure of $80 per pupil was associated with an additional month of achievement as measured by achievement test scores. This finding was based upon a multiple regression analysis that controlled for occupational level of parents, size of districts, and rate of growth of districts. It also controlled for IQ scores of pupils, which significantly interferes with the effects of school inputs.†

As a general conclusion from a preview of cross-sectional studies, there are so many nonschool factors influencing school achievement that we should expect only modest and slow increases in achievement with increases in school inputs. In addition, increases in achievement can best be attained by the increase of an appropriate combination of services rather than a broad-brush increase in spending. Although these conclusions are strengthened by examination of a large number of recent efforts at compensatory education, the results are as yet too unclear for us to ascertain with any certainty the incredients of the successful program.[77]

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* Reference 64, p. 53.

† Reference 94. There is considerable literature on the relationship between school achievement and IQ, which we will not cover here. Both the Coleman and Project TALENT studies concluded, however, that the relationship between the two is so high as to preclude assuming that they measure independent attributes. For example, the Coleman Report found that ability scores (IQ) showed more between-school variation than the achievement scores (p. 294). Project TALENT was able to develop certain tests, termed "visualization" tests that are reasonably uncorrelated with achievement test scores, but these are very different from the "verbal ability" tests used as IQ measures in the New York study.

The Relation of School Inputs to Pupil Achievement-Longitudinal Studies

The City of New York Demonstration Guidance Project

Goals. Initially, the primary goal of the Demonstration Guidance Project[136] was to stimulate children of low income families and minority groups to enter college. This early goal, however, was soon broadened since the project students were experiencing difficulty in maintaining themselves in college preparatory courses. In its broader scope, the project's goals became: to encourage students to remain in school longer; to provide cultural enrichment; to increase general scholastic success; and to decrease the sense of alienation. The encouragement of aspirations for higher education remained as part of the project for those students who were able to meet the educational requirements.

The Program Established for Project Students. The program of activities for the Demonstration Guidance Project contained many activities which are now recognizable parts of most Title I programs throughout the country. These activities were:

1. A complete guidance program.
2. A curriculum adapted to the needs of the students, with instruction and learning conditions conducive to the raising of achievement.
3. Remedial and clinical support, including psychological examination, special work, and psychiatric consultation.
4. Cultural contacts through attendance at musical, art, ballet, and theatrical events.
5. The education of parents to make them aware of educational and vocational opportunities for their children.
6. Provision of assistance in finding part-time employment for those requiring financial assistance.

Selection Criteria for the Experimental Population. The project was instituted deliberately in junior and senior high schools where the student population contained a high proportion of nonwhite students from low income families. When finally chosen, the experimental population included approximately 53% Negro, 29% Puerto Rican, 3% Hispanic, 13% white, and less than 3% Oriental.

The student population in the Demonstration Guidance Project (DGP) is representative of only the more able part of the Title I target population, since the criterion established for participation in the DGP was that IQ be no lower than 90, whereas no one is excluded from participation in Title I on the basis of low IQ or excessive grade retardation.*

Junior High School Results. Table 12 presents the results for three experimental classes in terms of grade equivalents. As shown, the average gain in paragraph comprehension per year increases as the number of years in the program increased--i.e., from the equivalent of 1.10 year for the 1-year class to 1.43 year for the 3-year class. For the same period, the gains in arithmetic reasoning were not as marked. A comparison of retardation levels against school norms for the appropriate grade levels shows that the project succeeded, with one exception, in reducing retardation in reading and arithmetic reasoning (see Table 13). In one case (paragraph comprehension), the project was able to produce a median performance above the grade norm for the project group with the longest exposure (3 years) to the program.

The High School Results. The Guidance Project started its effort with over 700 students at the junior high school level. Before being allowed to continue with the project in high school, all project students were re-evaluated to determine whether they should be allowed to continue on the project. A screening, in which only those with acceptable scholastic performance and acceptable ratings by teachers of their scholastic potential were admitted to the high school program, reduced the number of project students to 329.

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* Other criteria for participation in DGP were on arithmetic and reading achievement; the level of retardation was allowed to reach as much as two years. A rating on scholastic potentiality was also employed; students were rated on a four-point scale and accepted into the project if they were rated at the upper half of the scale.

Table 12

GAINS ACHIEVED IN TERMS OF GRADE EQUIVALENTS AT BEGINNING AND ENDING OF JUNIOR HIGH SCHOOL PHASE

	1st Experimental Class (1-year duration)	2nd Experimental Class (2-year duration)	3rd Experimental Class (3-year duration)
Paragraph meaning			
End	8.7	8.4	9.7
Begin	7.6	6.1	5.4
Difference	1.1	2.3	4.3
Average gain per year	1.10	1.15	1.43
Arithmetic reasoning			
End	7.3	7.8	8.5
Begin	7.0	6.8	5.7
Difference	0.3	1.0	2.8
Average gain per year	0.30	0.50	0.93

Source: Reference 136, Table 7, p. 39, Table 9, p. 42.

Table 13

DECREASE IN RETARDATION FOR THREE EXPERIMENTAL GROUPS

	(1-Year Difference) 1st Experimental Group Ninth Grade			(2-Year Difference) 2nd Experimental Group Eighth Grade			(3-Year Difference) 3rd Experimental Group Seventh Grade		
	Retardation		Percent Difference in Retardation	Retardation		Percent Difference in Retardation	Retardation		Percent Difference in Retardation
	Beginning	Ending		Beginning	Ending		Beginning	Ending	
Stanford Paragraph Meaning	-1.2	-0.1	91%	-1.7	-0.4	76%	-1.4	+0.3	121%
Stanford Arithmetic Reasoning	-1.8	-1.5	16	-1.0	-1.0	0	-1.1	-0.3	72

Source: Reference 136, Table 8, p. 41, Table 13, p. 70.

This procedure affords the opportunity to compare those who remained in the project against those who were released.

Table 14 shows that the project students had a graduation rate which was almost 13% higher than that of nonproject students. Removing 38 students in the nonproject group who were in a special academic program in other high schools, the difference in graduation rate for project students increases to 19%. The question may be raised that these results are not significant because the experimental project group had been "hand picked," and hence not representative of the total disadvantaged population in the original schools. This may be true; however, comparison of graduation rates for students from project junior high schools between (1) classes that graduated during the years of the project and (2) classes graduating in the 3 years prior to the project shows an improvement much greater than expected from national trends over these years, and therefore reasonably assignable to the project. The rate of high school graduation increased from 48.8% to 57.4%, whereas national trends would have resulted in a rate of only 51.4%.*

Post-High School Education for Project Students. Since one of the aspirations of the project was to maximize the number of students entering higher education, it is of interest to examine the record of the project students against those who were not allowed to continue with the project at the high school level. Table 15 shows that the continuing project students enrolled 51% of their number in post-high school education of all kinds, as opposed to approximately 33% from the other group. A major difference, however, occurs only with respect to full-time enrollment in two-year colleges.

In interpreting these results, we must realize that the group selected ultimately for treatment at the high school level represented those students who met certain criteria of achievement test scores, IQ, and grade average, and who also were judged most likely to enter college. That there was improvement in college attendance due to the program is supported by a

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* Reference 136, p. 94.

Table 14

FINAL HIGH SCHOOL STATUS OF PROJECT AND NONPROJECT STUDENTS
(329 Project and 210 Nonproject Students)

	Project Students		Nonproject Students	
	Number	Percent	Number	Percent
Academic diplomas	108	32.8%	46	21.9%
Other diplomas	147	44.7	90	42.9
Total completed high school	255	77.5%	136	64.9%
Still in high school February 1963	4	1.2	4	
High school dropouts	70	21.3	70	33.3
Status not known			17	

Source: Reference 136, Table 22, p. 88 and Table 24, p. 24.

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Table 15

POST-HIGH SCHOOL EDUCATION OF TWO EXPERIMENTAL GROUPS

Post-High School Experience	High School Project Students (total = 328)		Students With Junior High Project Experience Only (total = 210)	
	Number	Percent	Number	Percent
Four-year college				
Full-time	60	18.2%	38	18.1%
Part-time	16	4.9	6	2.9
Two-year college				
Full-time	36	10.9	8	3.8
Part-time	34	10.3	8	3.8
Special schools				
Full-time	10	3.0	4	1.9
Part-time	15	3.6	5	2.4
All of the above schools				
Full-time	106	32.2	50	23.8
Part-time	65	18.8	19	9.0
Total	171	51.0%	69	32.8%

Source: Reference 136, Table 23, p. 89, Table 25, p. 92.

comparison for pupils from project junior high schools between (1) the classes that graduated high school during the years of the project, and (2) the classes that graduated during the three years before the project began. Table 16 combines high school participants in the project, high school nonparticipants (but who were in the junior high phase), and spill-over effects upon nonparticipants who may have been stimulated unknowingly.

Table 16

TYPE OF POST-HIGH SCHOOL EDUCATION FOR JUNIOR HIGH SCHOOL WITH 43 GRADUATING CLASSES DURING PROJECT AND PRE-PROJECT YEARS

		Four Year Liberal Arts		Two Year Community Colleges		Special Schools*	
Years	Total No.	No.	%	No.	%	No.	%
Project (1957-59)	1281	129	10.07	107	8.35	59	4.60
Pre-Project (1954-56)	1392	81	5.81	15	1.07	33	2.37

* Business schools, mechanical institutes, beauty culture schools, and hospital schools.

Source: Reference 136, Table 27, p. 95.

The table shows that the percentage of students entering post-high school institutions during the project years is more than twice the percentage of those continuing post-high school during the earlier period. This difference cannot be explained by the national trend of increasing college attendance because between the years of interest, college attendance nationally increased only slightly, from 52.8% to 54% (see Table 2). The authors feel that doubling enrollment in four-year institutions can be partly attributed to effects of the Demonstration Guidance Project.

Staffing and Costs for the DGP--Junior High School Phase. Each project group was provided a full-time counselor who moved along with his group. The project also was given the part-time services of a psychiatrist, a psychologist, and a social worker. Two teachers were assigned part-time to remedial arithmetic, one to foreign language remedial service, and one to educational and cultural enrichment. Clerical and research assistants were also assigned to the project.

The average per capita cost was approximately $80 per year above the regular allotment for students in conventional junior high school classes.

Staffing and Costs for the DGP--High School Phase. The per-pupil staff and financial allotments were higher for the senior high school phase than for the junior high school phase. This was due, partly, to the reduced number of students enrolled in the project during high school. There was one additional classroom teacher for every 30 students as compared to one extra position for 160 students in the junior high school phase. Each project class kept its counselor, although project high school classes were half the size they had been in junior high school. A psychologist and a social worker were assigned on a part-time basis.

The cost was approximately $250 more per student than nominal per capita expenditures at the high school level.

The Higher Horizons Program of the City of New York

Scope of the Higher Horizons Program. The Higher Horizons Program was initiated in 1959 for children from low income groups.[135] It was designed to attack problems of scholastic retardation as early as the third grade. It attempted to reach students at all ability levels and at all grade levels, although evaluation reports concentrated on accomplishment at the elementary and junior high grade levels. At its peak of operation, the program included 64,000 children in 52 elementary schools, 13 junior high schools, and 11 high schools.

Additional Pupil Expenditures. The following per capita costs were estimated for the program:

Elementary	$61
Junior High School	61
Senior High School	70

These figures must be related to the ongoing per-pupil costs in the disadvantaged, or "service" schools, as they are named in New York City. At the elementary level, a majority of the schools included in the program were service schools in which there was high evidence of scholastic problems indicated by low IQ, reading ability less than the designated standard, language expression and comprehension below the norm, transiency, and nutrition deficiencies. Such schools were already receiving from $150 to $175 per pupil above similar expenditures in conventional schools before those amounts we have indicated earlier were added. In effect, Higher Horizons schools were receiving over $200 per pupil above per-pupil expenditures in non-Higher Horizons New York City schools.

General Design of the Program. The procedure and techniques used are familiar components of compensatory education programs. They included:

1. The adaptation of methods and materials to the children in the program.
2. Provision of additional guidance services to raise student aspirations, to provide counseling at the individual and group level, and to develop new guidance methods for these children.
3. Training of teachers in order to adapt them to special needs of the program.
4. Education for parents so that they would respond more positively to their children's educational aspiration.
5. Curriculum enrichment.
6. Nonschool cultural experiences whith the child in the program normally could not afford.
7. Remedial services in reading and other scholastic areas.

The design established an array of experimental and control schools with each matched on relevant criteria. Schools were designated as experimentals and control so that they were matched on: ethnic composition, IQ scores, reading ability, geographical location, total student population. As may be expected in a compensatory education, the experimental schools had a smaller average class size, a larger percentage of regular teachers, and a greater number of professionals per thousand students in the form of teachers and guidance personnel. The general picture of the design is then one which permits the evaluation of change in experimental schools against nominal educational progress or retardation for equated groups in control schools.

Results of the Higher Horizons Program. Sweeping generalizations may not be made regarding the results of the program unless one is content with knowing that it failed to produce significant change in some instances and succeeded in others. In order to understand what went on in this program, one must look at tests conducted against either total grade levels or subsets within grades. Some subsets, i.e., high ability vs low ability, boys vs girls, etc., gained more from the program than others.

Reading Comprehension at the Elementary Level. A comparison of experimental and control students on reading comprehension in the sixth grade did not reveal any differences. A more rigorous test was then made to see whether differences would emerge if pairs were matched within three levels of IQ. It is possible that the program may have been more effective for some IQ groupings than others. This test did not produce any differences, and so no significant gains were attributed to Higher Horizons in reading comprehension as a function of IQ groupings.

Reading comprehension also was evaluated by comparing actual against expected gains. Sugdents were tested during the first semester of the third grade, six months later in the third grade, and then at the end of the fourth grade. Expected scores were determined by estinating the normal grade equivalent anticipated at each testing date for the average IQ of the experimental students. The following is a comparison of expected and actual gains:

	After 6 Months Third Grade	After 11 Months Third Grade	After 16 Months Fourth Grade
Actual	7.3 months	7.5 months	14.8 months
Expected	4.7 "	9.2 "	13.9 "
Difference	+2.6 "	-1.7 "	+ .9 "
Means	2.73	3.46	4.21

Source: Reference 135, Table 37, p. 51.

In 16 school months, a gain of 13.9 months was expected and this was slightly exceeded--by 0.9 of a month. The slight gain over the expected was not statistically significant.

Arithmetic Computation and Problem-Solving at the Elementary Level. On both arithmetic processes, an experimental population tested significantly higher in the sixth grade after they had been matched earlier on the same abilities in the third grade. We present an example of the sshift which occurred:

		Arithmetic Problem-Solving						
		Experimental		Control				
Grade	M	Mean	Standard Deviation	Mean	Standard Deviation	Difference	t	p
4th	374	4.14	.83	4.14	.83	.00	.00	NS
6th	374	5.72	1.55	5.43	1.47	+.29	4.06	.01

Source: Reference 135, Table 49, p. 65.

In terms of expected performance, the experimentals slightly exceeded the expected IQ-based scores in arithmetic computation. In problem-solving, however, they wer 0.17 year behind expectancy.

	Difference Between Third and Fourth Grade Testing		
	Expected*	Actual	Difference
Computational Skills	1.45	1.49	+.01
Problem-Solving	1.48	1.31	-.17

Note: Expected values were determined from IQ.

Source: Reference 135, Table 44, p. 60, Table 45, p. 61

Although we are not aware of whether the control group was performing up to expectancy as determined from IQ, it is encouraging to find that, on the average, Higher Horizons students, although retarded in grade level, were working up to their IQ limits, on computational skills at least.

Results of Evaluation at the Junior High School Level. During the Junior High School phase of the Higher Horizons Program, a second control group was introduced. This group consisted of students who had enrolled in the experimental schools one year after the program had started. In addition to comparing results with a non-Higher Horizons (non-HH) control population, we also have the opportunity to see comparisons with another control group called the post-Higher Horizons (post-HH) group. The latter had exposure to two years of the program, as contrasted with three complete years for the Higher Horizons group. This addition enables us to answer the question of whether two years were as effective as three years in producing changes in achievement.

All experimental and control groups must be considered as matched by their means and standard deviations on a pre-test of ability. Where matching failed to produce similarities, the partialling technique of analysis of co-variance was used for adjusting final ninth grade scores to that they could be compared with other groups.

Reading Comprehension. We present summarized results in reading comprehension when the experimental group was compared to its two controls.

Only differences statistically significant at the 0.05 level are reported. Students were divided into intermediate and advanced reading groups, with results reported separately. In Table 17, there is a notable trend for the experimental students to exceed post-HH students in the same school, providing some indication that an extra year in the program resulted in significant gains. The intermediate reading group shows several years of retardation although it exceeds the post-HH group by one-fifth to one-third of a school year.

Differences are more marked for the advanced reading group, which exceeded the post-HH group by more than 1-1/2 years of reading achievement. Only in the case of the upper IQ (104-140) group do we derive a significant change from the non-HH control. Here the difference is equivalent to two months of achievement.

Since the pure case is represented by comparing experimentals with the non-HH group, we must conclude that only when we compare them at the upper end of the IQ range do we find a difference in favor of the experimental group. Since this is a restricted segment of the total group, however, the authors of Higher Horizons are reluctant to generalize from this result.

Having failed to find differences between experimentals and controls, we go on to the results presented on actual vs expected gains in reading comprehension. Table 18 presents Initial and Final Means based upon a 16-month interval (November, 1959 to May, 1961).

Under conditions of normal growth, we would expect a 1.6 year improvement. Although all ability groups were retarded with the exception of the High IQ group (Table 18), at final testing their growth rate exceeded normal expectation. The expected growth rates were adjusted for IQ levels and revealed that the Middle IQ group actually had achieved a growth of more than half a school year above what could be expected on the basis of its mean IQ For the total group, the growth was approximately half a school year above what could be expected on the basis of the group's mean IQ.

Table 17

RESULTS IN READING COMPREHENSION AT NINTH GRADE
Adjusted Means*
(Years)

	Experimental-HH Mean	Non-HH Mean	Post-HH Mean	Difference
Intermediate reading group				
Total group	5.38		5.20	0.18 (sig. at 0.05)
Upper IQ group (IQ 75 and above)	5.80		5.47	0.33 (sig. at 0.05)
Advanced reading group				
Total group	9.03		8.85	1.8 (sig. at 0.05)
Lower IQ group (IQ 65-96)	7.76		7.47	0.29 (sig. at 0.05)
Upper IQ group (IQ 104-140)	10.37	10.17		0.20 (sig. at 0.05)

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* Means were adjusted through analysis of co-variance so that any initial differences among groups could be held constant while comparing post-test on nineth grade means.

Source: Reference 135, Tables 98, 100, 102, 103, and 105, pp. 149, 150, 152, 153, and 154.

Table 18

INITIAL AND FINAL MEANS FOR THREE ABILITY GROUPS ON READING COMPREHENSION

IQ Groups	IQ Mean (Approx)	November 1959 Normal: 7.2 Initial	May 1961 Normal: 8.8 Final	Difference (Normal Growth 1.6)
High	110	6.79	8.94	+2.15
Middle	92	5.14	7.24	+2.10
Low	74	3.78	5.29	+1.51
Total	92	5.23	7.15	+1.92

Gains Adjusted for Levels of Ability (IQ)

IQ Groups	Actual Growth	Adjusted Expected Growth	Difference
High	2.15	1.77	.32
Middle	2.10	1.47	.63
Low	1.51	1.19	.32
Total	1.92	1.47	.45

Source: Reference 135, Tables 93 and 94, pp. 142-3.

Arithmetic Reasoning. Table 19 presents the rate of growth by ability levels and adjusted growth rates based on IQ. In all ability levels, there was a positive gain over the 16-month period between initial and final testing. However, it is quite apparent that all ability groups had performed below expectancy. It is quite evident that with respect to growth, the Higher Horizons experimental students did not have the same success in arithmetic reasoning as they had in reading comprehension.

Other Change Phenomena In The Higher Horizons Program. It would be an injustice to the Higher Horizons Program if we were to ignore changes other than reading and arithmetic achievement which took place during its implementation. There were changes in attributes such as general behavior, attitudes, aspirations, and reactions to the program. Positive changes in these areas may have "second generation" effects on reading and arithmetic achievement--i.e., subsequent student populations undergoing similar treatment may absorb "atmospheric" effects which could influence improved achievement later. We present some of these findings and indicate those found to be statistically significant as a function of the program. All of these which follow are imputed to the program.

Changes Attributable to Higher Horizons
(*=Statistically significant)

Elementary Program

Slightly higher gains in attendance were realized.

Truancy rates tended to be consistently lower.

Principals overwhelmingly favored continuation of the program.

Teachers favored continuation of the program.

*Non-classroom personnel favored the program more than teacher personnel.

Junior High Program

*Eighth grade experimental girls were rated higher on classroom behavior than their control counterparts.

Table 19

RESULTS IN ARITHMETIC REASONING BY ABILITY LEVELS

IQ Groups	Initial November 1959 (Normal 7.2)	Final May 1961 (Normal 8.8)	Difference (Normal Growth 1.6)
High	6.92	8.36	+1.44
Middle	5.63	6.88	+1.25
Low	4.48	5.45	+0.97
Total	5.67	6.89	+1.22

Gains Adjusted for Levels of Ability (IQ)

IQ Groups	Actual Growth	Adjusted Expected Growth	Difference
High	1.44	1.77	-0.33
Middle	1.25	1.47	-0.22
Low	0.97	1.19	-0.22
Total	1.22	1.47	-0.25

Higher Horizons students tended to get better ratins on their report cards for classroom behavior. (Statistics significant for eighth grade girls, ninth grade girls, and seventh grade boys.)

Attendance rates were slightly greater than rates of of the controls.

Suspension rates were consistently lower.

*Desired future occupations of a higher level were chosen.

*More Higher Horizons parents aspired to have their sons attend an academic or commercial high school.

Principals felt that the program had more than "some" positive degree of effectiveness in realizing its goals.

Only 9% of the teachers were in favor of discontinuing the program.

Higher Horizons in Retrospect. Higher Horizons and similar programs in other cities represent pioneering efforts in compensatory education on a large scale for the accommodation of thousands of scholastically retarded children. Higher Horizons has had over 64,000 students working under the program. Assuredly, programs conducted on so large a scope should provide meaningful background findings indicating what may be expected from Title I. Exception, however, should be taken with respect to pupil expenditures. Per pupil expenditures of $60 to $70 may be inadequate to bring about significant changes. The provision of Title I calls for federal assistance equal to one-half the current expenses of education, which in New York City would have meant expenditures five or six times the level of Higher Horizons.

If Title I programs which add large amounts to the nominal pupil expenditures succeed in demonstrating significant changes where Higher Horizons were unable to do so, it may be that additional expenditures were simply not large enough.

With respect to the general findings of Higher Horizons, when total experimental populations were tested against total control groups, generally no significant shifts in achievement were found. Yet our interest was drawn to two other trends in the findings which are significant to us:

1. The selection of subsets of students, on a matched basis or by ability groupings, revealed that differences were occurring. This, perhaps, is the critical point in the large scale programs--i.e., they do more for some subgroups than they do for others.
2. We saw greater growth when there were fewer requirements for verbal ability. We say, also, that students were often performing above IQ expectancies.

A final word on research design for massive programs. Typically, significant results can be explained, whereas the failure to find differences has no ready explanation. At the same time, one must have reservations about expectancies of a difference between two massive populations. We are discussing this program without knowing the effects of new and experimental curriculum materials, and without knowing the imagination and ingenuity expressed with the experimental students. If we could assume that teaching experience, teaching ability, and motivation were uniform through all schools, both experimental and control, we could then test for the difference as a function of the program. Probably, such standardized phenomena are not realizable in education since they are not amenable to control. Yet we could argue that the "Hawthorne effect" could have occurred. In other words, the differences in uncontrolled or atmospheric effects could have been greater within groups than between groups. Since we do not know what really went on, we are left to speculate that increasing the expenditures may have made a difference.

St. Louis Project: A Study on Dropout Prevention

The St. Louis Project[126] represents the recognition that dropouts leave school early to seek other outlets for their motivations, and that in many instances, they must become wage earners owing to home circumstances. Rather than attempting to have potential dropouts continue full time in school, the project enlisted the aid of the community in providing on-the-job training with subsequent compensation. Concurrent with their part-time jobs the project attempted a scholastic upgrading of the group, and compared their progress with a control group.

Design of the Project. A group of 506 potential dropouts was selected on the basis of such criteria as:

1. Regression in scholarship
2. Frequent grade failure
3. Poor attendance
4. Frequent transfers

The total sample was randomly divided into two groups. A criterior of IQ rating was applied which insisted that a sizable proportion of the group should score above 80 IQ. The mean IQ of the Work Group equalled 93.99 and the IQ mean of the Control Group equalled 93.57. Approximately 97% of both groups scored over 80 on IQ.

At the outset, the probability of lower dropout slightly favored the Control Group since they had a smaller percentage of nonwhite females who were prone to drop out and a larger percentage of white females who tended to remain in school longer.

Augmented Services for the Work Group. The experimental, or Work Group, received normal school services plus special counseling services, assistance in getting placed on jobs and in remaining on jobs, and special assistance on the job from employer and school personnel. Seven additional full-time counselors were employed. The report does not indicate the additional pupil expenditures made necessary by the project. The Control Group received the normal school services.

School Achievement Comparisons Between the Work and Control Groups. The report presents findings on the standardized testing of both groups. The general results in achievement do not reveal any significant margin of achievement for the Work Group over the Control Group. See Table 20. In reading and language usage, there even was a small contrary effect. Only a small percentage of students in either group was achieving at the high

Table 20

AVERAGE PERFORMANCE ON STANDARDIZED ACHIEVEMENT TESTS FOR WORK AND CONTROL GROUPS

	Reading		Language		Arithmetic	
	Work (N=327)	Control (N=255)	Work (N=343)	Control (N=254)	Work (N=317)	Control (N=245)
Mean achievement by school years	8.04	8.14	7.92	7.97	8.28	8.17
Mean differences		-.10		-.05		+.11
Percent achieving at tenth grade and above	9%	10%	7%	4%	6%	5%
Percent achieving at seventh to ninth grades inclusive	70%	71%	69%	74%	85%	80%

Source: Reference 126, Table XXIV, p. 27.

school level; from Table 20, it can be seen that the most of the pupils were achieving at seventh to ninth grade levels. As we have noted earlier, the data do not permit a separation of achievement levels according to actual grade placement. We do not know, for example, whether those about to graduate were achieving at high school level or below. We must treat the results, therefore, as representing typical achievement of both groups when tested in 1962 after the program had been in operation for two years.

Comparison of Dropout Rates Between the Work Group and the Control Group. The report on this project covers a two-year period--the 1960-61 and the 1961-62 school years. For the first year of operation, a 57% greater dropout rate was reported for the Control Group. This difference was reduced to a 4.4% difference in the second year but was still in favor of the Work Group.

We have taken, as an index of success in the program, thos who have graduated and those who are still in the program after two years. Failure is indicated by the number of dropouts (Table 21).

Table 21

	Work Group		Control Group		Total	
	No.	%	No.	%	No.	%
Dropouts	189	44	200	52	389	48
Graduated and Still in School	240	56	185	48	425	52
	429	100%	385	100%	814	100%

$X^2 = 4.32$ $P < 0.05$

Source: Reference 126, p. 22; SRI

On the basis of a X^2 test, we conclude that the 8% difference in dropout rate is statistically significant in favor of the Work Group. The Work Group lost 44% of its students but the Control Group lost 52%.

We may conclude, therefore, that after two years of operation, the St. Louis school and work-related project succeeded in significantly reducing the number of dropouts as compared to a Control Group matched on IQ score and relevant school performance variables. These findings prevailed despite the absence of differences in verbal and arithmetic achievement. The significance of the finding on dropout is enhanced because the composition of the groups was working against the finding of a difference, as previously noted. If the two groups had been more equivalent with respect to white and nonwhite females, a greater difference in favor of the Work Group might have been found.

Concluding Remarks

From our examination of the literature, we have noted a trend in the direction of work-study programs as a method of dropout prevention. This seems to overcome the motivational problems of potential dropouts who find school an unpleasant experience. Providing them with gainful experience on the outside, or even on the school grounds in other than a student role, is one way of attempting to keep them in school. It is unlikely, however, that Title I programs will move in this direction since Title I is geared for a long range effort--i.e., starting in elementary school and attempting a broad attack on the problems of the children involved.

It is too early to determine whether or not the Title I programs may ultimately be forced into the direction implied by the St. Louis work-study program in order to affect dropout. Certainly, if after several years of exposure to Title I, we would find large numbers of exposed students still contributing to the dropout rate, we should be alarmed, and perhaps look to other approaches, such as work-study combinations, for assistance.

Estimation of Title I Effects on Achievement

This section, to be included in the final report, will be based on actual achievement results obtained from Title I district reports, and from tabulation and regression analysis being conducted for this study by Project TALENT. The results will be in the form of statistical functions relating the following:

1. Title I expenditures to pupil achievement.
2. Pupil achievement to probability of being a high school graduate.
3. Pupil achievement to probability of entering and completing college.

See Chapter VI for a sketch of a case study that includes hypothetical relationships of the type to be found in the final report.

IV THE INCOME BENEFITS TO INVESTMENT IN EDUCATION

Contribution of Education to National Productivity

The previous chapter discussed the likelihood that Title I would affect educational achievement and grade level attainment. It will be made clear in the following pages that persons with higher levels of education attain higher levels of earnings, indicating a personal gain for investment in education. But, the principle question of interest to the federal government considering investment in education is the gain to society from additional education. One may ask whether the higher income of people with more education is a real measure of education benefits or is a surrogate measure for education-related attributes such as possession of higher innate ability, prejudice of employers in favor of persons with diplomas or degrees, and artificial bars to occupation entry. The U.S. Census of Population--the main source of data relating earnings and education--provides no clue regarding these other attributes which may distort the true effects of education.

Economic theory would tell us that an employer is acting irrationally if he is paying a higher wage for a worker with a high school diploma, when he can hire at a lower wage an equally competent worker who does not have the diploma. Although some employers may act this way, the economic system will punish them with lower profits, as the shrewder employers will hire the equally productive, though less costly workers. However, if there is an excess supply of high-school level workers, those without diplomas will suffer a greater level of unemployment and lower annual average earning, even if the wage rates are the same.

As for bars to occupational entry, it is true that in some professions, there are arbitrary standards of education set for entry, such as the B.S. for architects and engineers, the M.D. for doctors, and the L.L.B. for lawyers. The existence of these barriers, however, represents society's view of the education necessary to perform proficiently in these professional capacities. The existence of degree requirements for entry into many professions results in large gains to college graduates over those with "some" college; but this "jump" is correctly viewed as a benefit to education from both society's and the individual's point of view.

Studies of Education Contribution

Direct evidence that education contributes to productivity is difficult to find, but some studies considering this issue do tend to support it.

Denison Study

The major recent study of productivity in the American economy is by Edward Denison, who estimated the direct effect of education on the earning power of the labor force. Using 1949 Census data, he took typical income differentials by years of education for workers of the same age. He then assumed "that three-fifths of the income differentials . . . result from the effect of more education on the ability to contribute to production; the remaining two-fifths reflect the tendency for individuals of greater ability and energy to continue their education, and that of other variables that are associated with, but not the result of, the amount of education."* Despite the crudity of his computation procedure, the interesting point is that education in combination with a residual factor called "Advance of Knowledge," accounts for 43% of the growth rate of real income in the United States from 1929 to 1957. If we assume that he has correctly measured the other direct contributors to economic growth, education and learning in the broad sense must play an important role in growth.

Wolfle-Smith Study

A study of more than 3,000 "superior"† male high school graduates in Illinois, Minnesota, and New York (Rochester) showed that twenty years after graduation from high school, there were clear-cut salary gains to individuals attaining additional education, taking into account each individual's standing in the high school graduating class and his intelligence scores.(208) This study tended to show that (1) for a given level of ability (as measured by class standing and IQ scores in high school), further education at the college level contributed to earnings, and (2) there was a positive contribution to earnings for additional higher education in which no degree was earned.

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* 60, p. 16.

† Superior meant that only those in the upper half of class standing in ability test score were included.

Cutright Study

A 1/2% sample of all men registered with Selective Service in Maryland in 1953 was selected for a project whose purpose was to study the effects of ability and education on economic success.(27) The names of men in the sample were matched with social security account numbers to obtain income data. Eventually 537, or 96% of the sample of 556 cases, were matched; however, only about 35% of these also had AFQT scores. The regression analyses were conducted for a final sample of 144 whites for which earnings data, education information, and AFQT score were available. The biases that result because of the process of sample reduction are described in the report. These biases make it difficult to use the results of the multiple regression analyses to estimate the effects of education on income. Nevertheless, one can conclude from Cutright's analyses that both education and ability affect the level of income. For the multiple regression, the AFQT score made three times the contribution to prediction of income than the level of education. Since, however, the AFQT measures both education and ability, it can be safely assumed that education has made some net contribution.*

Michigan Study

A study conducted by the Survey Research Center at the University of Michigan (using a direct interview technique with heads of 2,997 spending units selected as a stratified national sample of households) found that:

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* Reference 27, Table 19, p. 42.

> ". . . the level of education clearly affected wage rates and that the effect was not substantially reduced by the incorporation of a crude measure of intelligence."*

The measure was a composite index for average of high school grades and grade retardation for age level. As an example, a head of household, age 35-44 with 12 years of schooling, could expect to earn 18% more than the same age head with less than 12 years of schooling, after statistically "matching for sex, region, race, ability, physical condition, and others."

Brazziel Study

One of the most interesting studies shows the direct effects of general education on earnings and employment for a small number of men completing the Manpower Development and Training Act courses. Four groups of 45 men each were selected: Group A received a combination of general and technical education, Group B received only technical education, Group C received no instruction, and Group D (called the Placebo Group) received only simulated occupational information and guidance in order to test the presence of a "Hawthorne effect." The general education curriculum consisted of instruction in reading improvement, language arts, number skills, occupational information, and human relations, plus one hour of directed study per day. General and technical education were conducted for a half-day each. All groups were followed up by personal interviews one year after training. Tables 22 and 23 show that there were significant differences among them in percent employed and in salary per week at time of interview.(152)

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* Reference 100, Table 5-18, p. 63. See Table 5-1, p. 48, for list of independent variables in the multiple regression analysis.

Table 22

PERCENT OF GROUPS EMPLOYED AT THE END OF THE FOLLOW-UP PERIOD

Group	Percent Employed
A--(General and Technical Education)	95*
B--(Technical Education)	74
C--(Main Control)	59
D--(Placebo Control)	63

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* Significantly higher than paired group (Chi square test).

Source: Reference 152, Table 1.

Table 23

AVERAGE WEEKLY SALARIES

Group	Salary per Week at Interview
A--(General and Technical Education)	$83*
B--(Technical Education)	71
C--(Main Control)	46
D--(Placebo Control)	50

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* Significantly higher, .01 level of confidence (t-test)

Source: Reference 152, Table 2.

This small scale study shows the direct advantages of general education in improving earnings and reducing unemployment.

In general, the studies cited above support the two findings based on Census of Population data: (1) education contributes to earnings, and (2) this measured contribution represents gains in productivity to the nation.

Private Benefits to Education as Measured by Differences in Lifetime Earnings

The private returns to education are measured quantitatively by the disccounted lifetime earnings, hereinafter called L and given by the formula:

$$L = \sum_{a=s}^{e} \frac{Y_a}{(1+i)^{a-b}} \qquad (1)$$

where:

a refers to age, the sum is taken over ages

s is the age at which the income stream begins

e is the age at which the income stream ends

Y_a is the income at age a

b is the age to which the discounting is done

i is the discount rate

Equation 1 is appropriate to use if the life history of an individual's income is known. If the amount is to be estimated for the future of someone who is now at age b, then the appropriate equation is for estimated discounted lifetime earnings (or $\hat{L}$) given by:

$$\hat{L} = \sum_{a=s}^{e} \frac{Y_a(1+p)^{a-b}}{(1+i)^{a-b}} P_a \text{ or } \int_{a=s}^{e} Y_a(1+p)^{a-b}(1+i)^{-(a-b)}P_a \qquad (2)$$

where:

P_a is the probability of surviving to age a

p is the annual rate of change of earnings over time

Note that:

$$\frac{(1+p)^{a-b}}{(1+i)^{a-b}} = \left(\frac{1+p}{1+i}\right)^{a-b} = \frac{1}{\left(\frac{1+i}{1+p}\right)^{a-b}}$$

and

$$\frac{1+i}{1+p} = \frac{1}{1+j} \quad \text{where } j = i - p - pj$$

thus

$$\frac{1+i}{1+p} \text{ is approximately } \frac{1}{1+i-p}$$

Therefore, formula 2 can be put into the more convenient form:

$$\hat{L} = \sum_{a=s}^{e} \frac{Y_a P_a}{(1+i-p)^{a-b}} \qquad (3)$$

or

$$\hat{L} = \sum_{a=s}^{e} \frac{Y_a}{(1+d)^{a-b}} P_a$$

where d is a discount rate which takes into account both i and p.

Following is a discussion of each variable in the equation, including problems of estimation, computation, and use of terms. The discussion will begin with the easier concepts; the variable Y_a, being the most complex, will be saved for last.

It is necessary to pick some age as the basis of the computations; incomes, costs, and benefits are discounted to that age, denoted by b in the equations above. Typically, b is the age at which the relevant decisions regarding investments are made; but since change in the value of b multiplies all costs and all benefits by a constant, the choice of b cannot alter the value of the cost-benefit ratio, but only the magnitude of discounted net benefits. Therefore, selection of b is not relevant to the basic decisions regarding further investment in education.

The probability of survival, P_a, is the probability that a person now at age b will survive until age a. More relevant would be figures representing the probability of being employable until age a. Mortality figures are a compromise.*

An arbitrary constant, e, is introduced to treat the end of the earnings period. Theoretically, e could be infinity, with income eventually declining to zero. For ease of computations, however, e was set to 65. For any value of d greater than zero, the precise value of e will not matter because the discounted value of earnings so far in the future will be negligible.

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* The mortality table used in the computations made for this chapter is based on U.S. Total Population (1959-1961). The table may be found in the "Life Insurance Fact Book," 1966, published by the Institute of Life Insurance, 277 Park Ave., New York, N.Y., 10017

A variable s is introduced to set an age at which the earning stream is assumed to start. As a first approximation, earnings are assumed to start after completion of education, with income zero before that time.* Implicit in the selection of s is the existence of a cost to the individual in foregone earnings between the ages of 14 and s (e.g., 18 for a high school graduate). The values of a and s are very critical for the computation of $\hat{L}$; changes in assumptions about s will drastically change the economic benefits estimated to flow from education. The selected values of s as a function of education are given in the following tabulation:

Education	Values of s
Elementary and secondary	
Grades 0-7	14
8	14
9-11	16
12	18
College	
First 3 years	20
Fourth year	22

The discount rate, d, used in the computations combines two rates: a time preference discount rate, i, and a rate of earnings increase, p. The preference discount rate reflects the relative value of present and future earnings. The rate of earnings increase has two components: (1) rate incorporates estimates of productivity change; and (2) elasticity of earnings with respect to education, due to relative growth of supply and demand for labor. The selection of values for i and p is discussed in a later section.

In this section, tables will be presented showing $\hat{L}$ for a range of values of d from -1 to 10. In the first set of calculations, it is assumed that real income will rise at a constant percent per year over the time period under consideration.* The discount rate may be used to estimate an internal rate of return to investment in education. This is discussed below along with the discussion of discounted lifetime benefits.

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* A later section of this chapter deals with the part-time earnings of persons who work while attending school. (Not included in progress report.)

Y_a, the most complicated variable involved with the estimation of $\hat{L}$, is also the most critical one. If the computation is to be performed for one person who has a life history in the labor force, then the appropriate figure to use for Y_a is the money income (in constant dollars), or earnings, received by that individual at age a. If, however, the computation is expected to yield, at a point in time, an estimate of expected lifetime earnings, and if the data are for earnings of people at various ages with given amounts of education, then the computations become complex. The following questions must be considered:

1. What is the appropriate income figure to use? The choices are total income, earnings, salary and wages, or some combination.
2. What is the appropriate population to use? There are data for "experienced male civilian labor force with earnings" as well as for other types of populations.
3. What is an appropriate income to use as "representative" of the population? The obvious choices are the mean or the median income for a population of income recipients; another possibility is the mean of an income distribution which was censored (in the usual sense of the work) by the data gatherer or subsequent users of the data--for example, in such a way that all incomes above $25,000 were listed as $25,000.
4. Finally, when the data are provided for age classes only (e.g., 5 year intervals), how should the interpolation and/or extrapolation be done in order to get Y_a for ages not given?

Solutions for each of these problems will be presented, with the reminder that the primary concern of these computations is to estimate, for lifetime earnings, the differences that can be attributed to education.

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* Alternative assumptions, involving changes in d during the lifetime earning cycle, are considered later.

Consider a person's total income to consist of three parts: (1) wages and salary received for services (or time) rendered on a job; (2) income received as rental on real capital owned by the person, and as profits from a business; and (3) self employment income, income which might be considered as wages or salary except that the worker is his own employer.

The income of 2 does not belong in a discussion of income as a function of education. This income is basically related to a person's real wealth rather than his education or his talent. Therefore, as much as possible, given the available data, total income less rentals-profits will be used for Y_a computations.[*] This figure will be referred to as earnings.[†]

There are many "appropriate" populations from which to draw estimates of earnings. The choice depends on the question to be asked of the data. There are two ways to define the population being studied: by worker characteristics, and by worker status.

The first differentiates the population according to characteristics of the workers--male or female, white or nonwhite, etc. In this context, as many subpopulations should be considered as the data will allow, and will show expected significant differences in returns to education. The tables presented later show that lifetime earnings and lifetime benefits from education differ significantly between white and nonwhite, and between male and female. The amount of such analysis which can be carried out is severely limited by the data available.*

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[*] Our exclusion is made because we lack data, Since some of the income from real capital would seem to be attributable to education: better educated people (and thus better informed people) should get a higher rate of return on their real investments. However, at this time, there are no data on the rate of return to investments as a function of education. It could also be argued that a certain portion of the return on real investment represents wages or salary in the sense that the investor pays himself for the time spent in managing the investment. But here again, data are lacking.

[†] Hanoch, reference 79, for reasons not entirely clear from his presentation, considers only wages and salary income. He therefore omits the self employment portion of earnings.

The other method of defining a population depends on the person's status in the work force. For appropriate estimates of benefits, one would like to have the full-time equivalent annual earnings for those people in the labor force during the year. This can be approximated by using either the earnings of those who worked full-time, or alternatively, one could take the actual earnings during the year and divide this amount by the fraction of the year in which the person sought employment. Thus, a person who chose to work for only six months and who earned $4,000 during that time would be considered to have earnings at a yearly rate of $8,000. On the other hand, involuntary unemployment is considered equal to zero earnings; a person who wished to work the full year, but who was involuntarily unemployed for six months and who earned $4,000, would be considered to have only $4,000 yearly earnings.†

Another aspect of the problem of full-time equivalent annual earnings is the number of hours worked per week. This is more relevant for analyzing the female than for analyzing the male labor force. It seems reasonable that males work "full-time" when they are working; whether "full-time" means 30 hours a week for a plumber, 9 hours a week for a professor, 40 hours a week for a production worker, or 60 hours a week for a farmer is not relevant to this discussion. On the other hand, part-time work by females is quite common. The specific problems involved with the female labor force are discussed elsewhere.*

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* Some of the limitations of the published data may be avoided by considering data from a one-in-a-thousand sample. This sample, made available by the Census in raw form, has been used in this study. There are, however, serious questions which must be raised about the accuracy of estimates derived from this data. Those questions are discussed in Appendix C on the one-in-a-thousand sample.

† The assumption is that people who are voluntarily unemployed could find work, or at least would have the same chance of finding work as those who are either employed or involuntarily unemployed. It is also assumed, at this point, that unemployment has no greater significance than zero earnings. A separate section discusses the question of unemployment rates as a function of education; that section brings up the question of whether unemployment is a qualitatively different problem than that of earnings.

If we consider the expected discounted lifetime earnings of someone about to enter a specific segment of the labor force, it follows that Y_a should be taken as the mean earning for workers in that group. There are, however, two arguments against using means; both would include people reporting very high earnings (more than 5 times the mean earnings, for example). It can be argued that the exceptionally high earnings are unlikely to be the result of education but rather will reflect exceptional abilities or good fortune. One example would be provided by a proprietor whose business happened to be in the right place at the right time. Further, income that is a return to physical capital would be reported as earnings under some circumstances, especially for the self-employed. The computation of mean income or earnings includes a full weighing of very high earnings; e.g., computation of a $100,000 earning is worth 100 times as much as a $1,000 earning. On the other hand, the median, being simply a count of persons with earnings, is not so affected. Table 24 shows that the difference between the mean and median earnings increases markedly as a function of education, indicating that the high earnings which create the difference are associated with high levels of education.

Table 24

EARNINGS IN 1959 FOR THE MALE CIVILIAN LABOR FORCE,
AGE 25-46, AS A FUNCTION OF YEARS OF SCHOOL COMPLETED
(Thousands of Dollars)

Years of School Completed	Mean Earnings	Median Earnings	Difference
Total	$ 5.85	$5.08	$0.77
Grades 0-7	3.66	3.40	0.16
Grade 8	4.73	4.47	0.26
Grades 9-11	5.88	5.04	0.34
Grade 12	6.13	5.54	0.59
College - 1st to 3rd	7.40	6.12	1.28
College 4th	9.26	7.43	1.83
5 or more years	11.14	7.97	3.17

Source: Special Report PC(2)-7; 5% sample of 1960 Census of Population.

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* Not in progress report.

Insofar as these high earnings do not reflect the results of education, but do reflect factors highly correlated with education, the benefits to education will be biased upward significantly by the use of mean earnings as a measure of earnings attributable to education. An alternative interpretation is that more education makes accessible to individuals positions and situations that provide very high rewards. Thus, the difference between means and medians may reflect in part the rewards to those willing to invest in more education in order to have a chance at the "special" situations. If this interpretation of the difference is correct, then risk-takers should look at mean returns and risk-averters at median returns in deciding whether or not to invest in further education for themselves. An alternative to median earnings is mean earnings from a censored sample; if the sample is censored in such a way that all income above $25,000 were reported as being exactly $25,000 then the effects of the upper tail of the earnings distribution would be eliminated. For this study, lifetime earnings are computed using both median and mean earnings.

The final point to be discussed with respect to the income figures is the smoothing, interpolation, and/or extrapolation of the data in order to make estimates of Y_a for each relevant age. Data from the U.S. Census typically come in the form of one income figure for people in each age group--between 25 and 34, 35 and 44, etc. Occasionally the figures are given for five-year age intervals. Whenever that was the case, the figure was used at the mid-point of the interval. The income curve was then assumed to be piecewise linear between the established points--i.e., a linear interpolation was carried out to establish estimates for the other ages. The first and last line segments were then extrapolated in order to get estimates for the low and high areas. The value of $\hat{L}$ is fairly insensitive to the smoothing technique used.*

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* It would take more space than seems worthwhile in order to state this proposition rigorously and to prove it. The gist of the matter is that $\hat{L}$ is a weighted average of the Y_a. A change in the smoothing process will tend to make some of the values of Y_a larger and other values smaller; this change will not affect the weighted average significantly.

Benefits and the Internal Rate of Return

Suppose that $\hat{L}$ were to be computed for the members of the labor force having a certain number of years of school; this figure could then be compared with $\hat{L}$ for another portion of the labor force having more years of school. The difference between the two figures would then be an estimate of the benefit due to the extra years of education possessed by those having more schooling. Since the computations are based on cross-section data, different values of p, the rate of increase of earnings over time, may be used for the different levels of education to reflect different expectation for future earnings of each education level. Let expected discounted lifetime benefits be designated $\hat{B}_L$, where

$$\hat{B}_L = \hat{L}_{E_2} - \hat{L}_{E_1}{}^{*}$$

$$= \sum_{a=s_{E_2}}^{e} \frac{Y_{a_{E_2}}(1+p_{E_2})^{a-b} P_a}{(1+i)^{a-b}} - \sum_{a=s_{E_1}}^{e} \frac{Y_{a_{E_1}}(1+p_{E_1})^{a-b} P_a}{(1+i)^{a-b}}$$

$$= \sum_{a=s}^{e} \frac{\left[Y_{a_{E_2}}(1+p_{E_2})^{a-b} - Y_{a_{E_1}}(1+p_{E_1})^{a-b}\right] P_a}{(1+i)^{a-b}}$$

In the middle expression for B_L, the lower limits of the summation are subscripted to reflect the fact that persons with differing amounts of education will enter the work force at different ages. In the final expression, s should be taken to be the minimum age of s_{E_1} and s_{E_2}, and the value of $Y_{a_{E_2}}$ is defined to be zero for values that are less than s_{E_1}.

Two forms are shown for $\hat{B}_L$, to demonstrate that the discounted sum of the differences is equal to the difference of the discounted sums. In other words, the discounted benefit from education is the same as the benefit when measured in terms of discounted earnings.

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* E_1 and E_2 are two levels of education, such that $E_2 > E_1$.

From the private point of view, the only costs of education through the twelfth year,* are foregone earnings. Therefore the benefits as computed from the earnings data really are net personal benefits of education.

Becker,[56] Hanoch,[79] and others refer to an "internal rate of return" to an investment in education. This rate is defined to be the rate of interest (or discount rate) at which the net benefits of the education are zero. Thus, if one were to compute the discounted lifetime benefit of graduating from high school as a function of the interest rate, then there would be a unique discount rate at which the benefit is zero.† This is the rate at which discounted costs equal discounted benefits; if an alternative investment were available at a higher interest rate, then one would take it rather than investing in education.

The above example has been in terms of high school graduation. The same logic would apply to any other year(s) of education. The above example has also assumed that the foregone earnings were were the sole cost of education and that the private costs and returns were the only items under consideration. If public costs and benefits are to be considered, then the entire question becomes more complex; the costs of schools must be estimated as well as the benefits to society from the extra productive capacity of educated workers. These questions are dealt with below.*

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* In states with tuition free junior colleges, one could extend this assertion to the fourteenth year; in states with tuition free universities and colleges, it could be extended to all of education in the sense that free education is available. Alternatively, and to the same end, one could assume that college students have earnings from part-time and summer work which approximately equal the direct costs of college. This possibility is examined later. When estimating social rather than private benefits, all costs of education must be considered.

† The existence and uniqueness of that discount rate follows from the assumption that the difference between the net earnings of a high school graduate and a high school drop-out are a monotonic increasing function of age. Thus, at high discount rates, the early working years are dominant; during these years, the graduate is still in school and his earnings are lower than those of the drop-out. At lower discount rates, the many years during which the graduate earns a higher income become dominant; there is an interest rate at which the two effects balance.

The most comprehensive single source of information on earnings and education is provided by the 1960 Census of population. Census data have been the primary source for most of the previous studies on education and earnings.† Tables 25 to 30 are based on data contained in the Census subject report PC(2)-7B entitled Occupation by Earnings and Education.[4] The data are for males in the experienced civilian labor force with earnings in 1959.‡ Tables are shown for white and nonwhite separately as well as for the combination of the two.** One set of tables (Tables 26, 28, 30) uses median earnings by age and education for Y_a and the other (Tables 25,

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* Although this method of computing expected lifetime earnings may accurately reflect the financial effects of education, there is serious doubt as to whether an individual, when faced with a decision as to continuing or dropping out from school, would perform such a computation. Aside from nonmonetary reasons, such as "liking school," or a "richer life" through education, the fact still remains that one can "live better" on $4,000 a year as a student than one could on that amount as a working man. Some of this effect is attributable to the consumption benefits of education--for example, cheaper entertainment, lower living expenses, etc. Some of the effect comes from a "different standard of living" for students. If this effect were to be taken into account in an organized way, one would have to delve into the questions of the indifference curves of students, of the utility of staying in school for the pure joy of being a student, etc. The problem is very knotty and will not be treated here.

† For example, Becker, Miller, Hanoch, and Houthakker

‡ The experienced civilian labor force is defined to be persons over 14 who were not in the armed forces during the week preceding the taking of the census, and who either had a job during that week or who listed themselves as unemployed but who had worked sometime in the past. There is a slight inconsistency in the fact that the population is defined as of the week preceding the Census, but the earnings data are defined in terms of the calendar year 1959.

** The Census category of "white" includes "white with Spanish surname." "Nonwhite" includes everyone else. There is some indication from the computing done directly from the Census one-in-a-thousand sample that, in terms of benefits from education, it would be more consistent to include the "white with Spanish surname among the "nonwhite" population; it would probably also be consistent to include the Oriental races with the "white" category.

Table 25

MEAN EARNINGS OF CIVILIAN LABOR FORCE IN 1959--
DISCOUNTED INCOMES OF ALL MALES

	Years of Education						
Discount Rate	0-7	8	9-11	12	1-3 COL	4 COL	5+COL
-1	215.32	278.62	315.13	354.09	414.68	532.22	625.54
0	163.90	212.39	237.65	263.99	304.00	384.89	448.12
1	127.72	165.74	183.19	200.86	226.99	283.13	326.03
2	101.81	132.29	144.24	155.88	172.57	211.81	240.82
3	82.92	107.88	115.90	123.29	133.49	161.06	180.57
4	68.91	89.75	94.90	99.27	104.98	124.40	137.35
5	58.33	76.05	79.08	81.26	83.87	97.53	105.94
6	50.21	65.52	66.95	67.54	67.98	77.54	82.80
7	43.86	57.29	57.50	56.92	55.85	62.46	65.52
8	38.83	50.75	50.01	48.57	46.45	50.92	52.46
9	34.77	45.48	44.00	41.91	39.07	41.98	42.46
10	31.46	41.17	39.10	36.53	33.20	34.96	34.72

-1	63.30	36.51	38.96	60.59	117.55	93.32
0	48.49	25.26	26.33	40.02	80.88	63.23
1	38.02	17.46	17.66	26.14	56.14	42.88
2	30.48	11.96	11.64	16.68	39.24	29.02
3	24.96	8.02	7.39	10.20	27.57	19.51
4	20.84	5.15	4.37	5.72	19.42	12.95
5	17.72	3.02	2.19	2.60	13.66	8.41
6	15.32	1.43	0.60	0.44	9.56	5.26
7	13.43	0.21	-0.57	-1.07	6.61	3.06
8	11.93	-0.74	-1.44	-2.12	4.47	1.54
9	10.71	-1.48	-2.09	-2.84	2.90	0.48
10	9.72	-2.07	-2.57	-3.33	1.76	-0.24

INCOME DATA FOR SPECIFIC AGES WAS OBTAINED BY
INTERPOLATION FROM DATA GIVEN FOR SELECTED AGES
ALL INTERPOLATION USED WAS LINEAR

MORTALITY TABLE TAKEN FROM U.S. EXPERIENCE 1961

PROGRAM WILL NOT ALLOW STARTING AGE GREATER THAN 23

INCOMES ARE DISCOUNTED BACK TO AGE 14

Table 26

MEDIAN EARNINGS OF CIVILIAN LABOR FORCE IN 1959--
DISCOUNTED INCOMES OF ALL MALES

Discount Rate	Years of Education 0-7	8	9-11	12	1-3 COL	4 COL	5+COL
-1	200.07	266.28	293.90	315.60	340.21	415.17	434.60
0	152.25	203.77	223.21	237.94	253.10	304.40	316.02
1	118.60	159.61	173.24	183.08	191.83	227.03	233.58
2	94.50	127.86	137.31	143.65	148.02	172.14	175.41
3	76.93	104.62	111.01	114.81	116.20	132.62	133.76
4	63.89	87.32	91.42	93.37	92.70	103.73	103.51
5	54.05	74.20	76.57	77.15	75.08	82.29	81.21
6	46.49	64.09	65.13	64.68	61.65	66.15	64.55
7	40.59	56.17	56.17	54.93	51.27	53.83	51.93
8	35.91	49.86	49.04	47.21	43.13	44.30	42.24
9	32.14	44.76	43.29	41.00	36.66	36.84	34.72
10	29.06	40.58	38.58	35.95	31.46	30.92	28.81

-1	66.21	27.62	21.70	24.62	74.95	19.43
0	51.51	19.44	14.74	15.16	51.30	11.62
1	41.01	13.63	9.84	8.75	35.20	6.55
2	33.36	9.45	6.34	4.38	24.12	3.26
3	27.70	6.38	3.81	1.38	16.42	1.14
4	23.43	4.10	1.95	-0.67	11.03	-0.22
5	20.15	2.37	0.57	-2.07	7.22	-1.08
6	17.60	1.04	-0.46	-3.03	4.50	-1.60
7	15.57	0.00	-1.24	-3.67	2.56	-1.90
8	13.95	-0.82	-1.83	-4.08	1.17	-2.06
9	12.62	-1.47	-2.28	-4.34	0.17	-2.12
10	11.52	-2.00	-2.63	-4.49	-0.54	-2.11

INCOME DATA FOR SPECIFIC AGES WAS OBTAINED BY
INTERPOLATION FROM DATA GIVEN FOR SELECTED AGES
ALL INTERPOLATION USED WAS LINEAR

MORTALITY TABLE TAKEN FROM U.S. EXPERIENCE 1961

PROGRAM WILL NOT ALLOW STARTING AGE GREATER THAN 23

INCOMES ARE DISCOUNTED BACK TO AGE 14

Table 27

MEAN EARNINGS OF CIVILIAN LABOR FORCE IN 1959-- DISCOUNTED INCOMES OF MALES, WHITE

Years of Education

Discount Rate	0-7	8	9-11	12	1-3 COL	4+COL	TOTAL
-1	234.44	286.55	325.58	360.76	422.34	584.56	341.24
0	178.65	218.85	246.01	269.08	309.66	421.04	255.99
1	139.34	171.11	190.02	204.83	231.24	308.29	195.87
2	111.17	136.84	149.93	159.05	175.81	229.42	152.77
3	90.61	111.80	120.71	125.86	136.00	173.46	121.35
4	75.35	93.18	99.03	101.39	106.97	133.17	98.05
5	63.81	79.09	82.68	83.05	85.46	103.74	80.50
6	54.94	68.25	70.12	69.06	69.27	81.94	67.07
7	48.01	59.76	60.32	58.23	56.91	65.57	56.62
8	42.51	53.01	52.55	49.71	47.34	53.10	48.38
9	38.08	47.56	46.30	42.92	39.82	43.50	41.78
10	34.45	43.10	41.19	37.42	33.84	35.99	36.44

-1	52.10	39.03	35.18	61.59	162.21
0	40.20	27.16	23.06	40.58	111.38
1	31.76	18.92	14.81	26.41	77.05
2	25.67	13.09	9.12	16.76	53.62
3	21.19	8.90	5.15	10.14	37.45
4	17.84	5.85	2.36	5.58	26.20
5	15.28	3.58	0.37	2.41	18.28
6	13.30	1.87	-1.06	0.21	12.67
7	11.74	0.56	-2.09	-1.32	8.65
8	10.49	-0.46	-2.83	-2.38	5.77
9	9.48	-1.26	-3.38	-3.10	3.68
10	8.64	-1.90	-3.77	-3.58	2.16

INCOME DATA FOR SPECIFIC AGES WAS OBTAINED BY
INTERPOLATION FROM DATA GIVEN FOR SELECTED AGES
ALL INTERPOLATION USED WAS LINEAR

MORTALITY TABLE TAKEN FROM U.S. EXPERIENCE 1961

PROGRAM WILL NOT ALLOW STARTING AGE GREATER THAN 23

INCOMES ARE DISCOUNTED BACK TO AGE 14

Table 28

MEDIAN EARNINGS OF CIVILIAN LABOR FORCE IN 1959--
DISCOUNTED INCOMES OF MALES, WHITE

Years of Education

Discount Rate	0-7	8	9-11	12	1-3 COL	4+COL	TOTAL
-1	222.38	274.26	303.12	320.48	345.89	432.43	306.51
0	169.68	210.33	230.71	241.72	257.29	316.19	233.71
1	132.53	165.12	179.47	186.06	194.98	235.14	181.86
2	105.87	132.56	142.57	146.05	150.44	177.77	144.27
3	86.39	108.71	115.52	116.79	118.08	136.55	116.54
4	71.92	90.92	95.35	95.01	94.19	106.48	95.72
5	60.97	77.41	80.03	78.54	76.28	84.23	79.84
6	52.55	66.98	68.21	65.87	62.63	67.52	67.51
7	45.96	58.80	58.94	55.97	52.08	54.79	57.80
8	40.72	52.27	51.55	48.12	43.81	44.98	50.04
9	36.50	46.99	45.57	41.81	37.23	37.31	43.74
10	33.04	42.66	40.67	36.66	31.95	31.24	38.58

-1	51.88	28.86	17.36	25.41	86.55
0	40.65	20.37	11.01	15.57	58.90
1	32.59	14.35	6.59	8.92	40.16
2	26.70	10.00	3.48	4.39	27.33
3	22.32	6.81	1.26	1.30	18.47
4	19.00	4.43	-0.33	-0.82	12.29
5	16.44	2.62	-1.49	-2.26	7.95
6	14.43	1.23	-2.34	-3.24	4.89
7	12.84	0.14	-2.96	-3.69	2.72
8	11.55	-0.72	-3.42	-4.32	1.17
9	10.49	-1.42	-3.76	-4.57	0.07
10	9.61	-1.98	-4.01	-4.72	-0.71

INCOME DATA FOR SPECIFIC AGES WAS OBTAINED BY
INTERPOLATION FROM DATA GIVEN FOR SELECTED AGES
ALL INTERPOLATION USED WAS LINEAR

MORTALITY TABLE TAKEN FROM U.S. EXPERIENCE 1961

PROGRAM WILL NOT ALLOW STARTING AGE GREATER THAN 23

INCOMES ARE DISCOUNTED BACK TO AGE 14

Table 29

MEAN EARNINGS OF CIVILIAN LABOR FORCE IN 1959--
DISCOUNTED INCOMES OF MALES, NONWHITE

Years of Education

Discount Rate	0-7	8	9-11	12	1-3 COL	4+COL	TOTAL
-1	151.47	196.17	205.22	227.11	242.26	307.65	183.85
0	115.78	149.57	155.46	171.06	181.11	226.05	139.68
1	90.57	116.67	120.30	131.44	137.97	168.93	108.26
2	72.44	93.06	95.04	102.94	107.04	128.33	85.53
3	59.18	75.80	76.56	82.11	84.49	99.04	68.79
4	49.30	62.97	62.82	66.62	67.78	77.59	56.26
5	41.82	53.26	52.42	54.90	55.19	61.64	46.73
6	36.05	45.79	44.42	45.91	45.56	49.62	39.35
7	31.54	39.96	38.17	38.89	38.08	40.42	33.55
8	27.94	35.32	33.20	33.33	32.19	33.30	28.93
9	25.04	31.59	29.21	28.87	27.49	27.71	25.20
10	22.67	28.54	25.94	25.24	23.69	23.28	22.15

-1	44.70	9.06	21.89	15.15	65.39
0	33.78	5.89	15.60	10.05	44.94
1	26.11	3.63	11.13	6.54	30.95
2	20.62	1.98	7.91	4.10	21.29
3	16.62	0.77	5.55	2.38	14.55
4	13.67	-0.15	3.80	1.16	9.81
5	11.44	-0.84	2.48	0.29	6.45
6	9.74	-1.37	1.49	-0.35	4.06
7	8.42	-1.79	0.72	-0.80	2.34
8	7.38	-2.12	0.13	-1.14	1.11
9	6.54	-2.38	-0.34	-1.38	0.22
10	5.86	-2.59	-0.70	-1.55	-0.41

INCOME DATA FOR SPECIFIC AGES WAS OBTAINED BY
INTERPOLATION FROM DATA GIVEN FOR SELECTED AGES
ALL INTERPOLATION USED WAS LINEAR

MORTALITY TABLE TAKEN FROM U.S. EXPERIENCE 1961

PROGRAM WILL NOT ALLOW STARTING AGE GREATER THAN 23

INCOMES ARE DISCOUNTED BACK TO AGE 14

Table 30

MEDIAN EARNINGS OF CIVILIAN LABOR FORCE IN 1959-- DISCOUNTED INCOMES OF MALES, NONWHITE

	Years of Education						
Discount Rate	0-7	8	9-11	12	1-3 COL	4+COL	TOTAL
-1	138.92	188.29	199.25	221.77	234.40	270.99	171.23
0	106.29	143.23	150.82	167.21	175.94	199.98	130.30
1	83.21	111.45	116.60	128.62	134.56	150.16	101.14
2	66.60	88.65	92.01	100.85	104.78	114.66	80.02
3	54.44	72.01	74.03	80.53	83.00	88.96	64.45
4	45.37	59.65	60.66	65.41	66.79	70.08	52.77
5	38.50	50.32	50.55	53.97	54.54	55.99	43.87
6	33.20	43.15	42.77	45.18	45.14	45.32	36.98
7	29.05	37.55	36.70	38.31	37.82	37.13	31.56
8	25.75	33.12	31.89	32.87	32.03	30.75	27.23
9	23.08	29.55	28.01	28.49	27.40	25.73	23.74
10	20.89	26.65	24.85	24.94	23.65	21.72	20.87

-1	49.38	10.96	22.52	12.63	36.59
0	36.94	7.59	16.39	8.73	24.04
1	28.24	5.15	12.02	5.94	15.59
2	22.05	3.36	8.85	3.93	9.87
3	17.57	2.02	6.50	2.46	5.97
4	14.27	1.01	4.75	1.38	3.29
5	11.81	0.23	3.42	0.57	1.45
6	9.94	-0.37	2.40	-0.03	0.18
7	8.50	-0.85	1.61	-0.49	-0.69
8	7.37	-1.23	0.98	-0.83	-1.28
9	6.48	-1.54	0.48	-1.09	-1.68
10	5.75	-1.79	0.08	-1.29	-1.93

INCOME DATA FOR SPECIFIC AGES WAS OBTAINED BY
INTERPOLATION FROM DATA GIVEN FOR SELECTED AGES
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MORTALITY TABLE TAKEN FROM U.S. EXPERIENCE 1961

PROGRAM WILL NOT ALLOW STARTING AGE GREATER THAN 23

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27, 29) uses the means. Values of $\hat{L}$ are shown for discount rates varying from -1% to 10%. The breakdown by years of schooling is as given in the Census document. The table immediately below the table of $\hat{L}$ shows the differences between the columns. The figures in these columns are the benefits attributable to each level of schooling over the previous level.* The benefits in each column decrease as the discount rate increases. These tables may be used to estimate the internal rates of return for the various levels of schooling (on the assumption that the private cost of the schooling equals the foregone earnings for the time the person is in school and that the productivity increases, p, are the same for all educational levels.)

There are several interesting points to be noted from a comparison of the results for means with those for medians. For all ages and educational levels, the mean earnings are higher than the median, indicating a skewness to the earnings distribution. As might be expected, the skewness is greater at the higher educational levels; this becomes evident if internal rates of return are compared, or if the benefits are compared. For median earnings, the benefits are higher only at the lowest educational levels, and the difference here is probably not significant. When computed as a function of mean earnings, the internal rate of return is higher for all levels of education above grammar school. Estimated internal rates of return are:†

	Grades					
	0-7 to 8	8 to 9-11	9-11 to 12	12 to 13-15	13-15 to 16	16 to 17+
Using medians	10+	7	5.5	3.6	9.2	3.7
Using means	10+	7.3	6.5	6.3	10+	9.7

The internal rate of return is used here as a way to compare the benefits from education in order to avoid the necessity of picking a discount rate; if the internal rate of return is higher in case A than in case B, then the benefit in case A will be higher than the benefit in case B for any discount rate. In order to compute the estimated rate of return on expenditures in education, it will be necessary to pick a discount rate and to compare the benefits at that discount rate with the costs. Those computations are carried out below.

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* Not taking into account any influences on earnings that might be correlated with education, other than sex and race. Hanoch's work indicates that most other effects can be ignored.

† The table is derived from Table 24 by estimating the discount rate at which the benefit would be zero. The estimation is done by a rough linear interpolation on the tabled benefit figures.

Benefits to Whites and Nonwhites Compared: Effects of Discrimination

The education levels shown in the "white" and "nonwhite" tables differ from those shown in the tables for the entire population. When the data are broken down by race, the earnings data are not shown separately for people with five or more years of college; instead these are combined with those having four years.

The most obvious characteristic appearing from a comparison between the white and nonwhite populations is the lower earnings of the nonwhites. This persists through all educational levels. The data show that mean lifetime earnings (at any discount rate) for nonwhite high school graduates are lower than those for whites with 0-7 years of schooling. The same statement is true of median earnings.

For the most part, the benefits from education are higher to whites than to nonwhites, because earnings are higher at all ages and at all educational levels for whites than for nonwhites; and average nonwhite earnings, expressed as a percent of average white earnings, do not increase with education.* There are exceptions: net benefits from high school graduation are greater for nonwhites than for whites at all discount

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* The data for all age levels together shows:

	Years of Schooling					
	0-7	8	9-11	12	1-3 College	4 or More College
Nonwhite mean earnings as a percent of white mean earnings	64%	69%	63%	64%	58%	55%

rates; and benefits for some college education are greater for nonwhites for discount rates of 3% or higher (indicating that the lifetime earning curves are steeper for whites than for nonwhites). The internal rate of return for high school graduation is higher for nonwhites than whites; the internal rate of return seems to be about the same for whites and nonwhites at the lowest educational level;* however, the internal rate of return because of graduation from college is much higher for the white population.

	Internal Rates of Return				
	Grammar School Graduation	Some High School	High School Graduation	Some College	College Graduation
Means					
White	10+	7.5	5.2	6.1	10+
Nonwhite	10+	3.8	8.2	5.5	9.3
Medians					
White	10+	7.1	3.7	3.6	9.1
Nonwhite	10+	5.5	10+	6.0	6.3

The lower earnings of nonwhites as compared to whites may be explained through a combination of three factors: (1) a lower achievement level for a given number of years of school completed so that, for instance, nonwhite college graduates may have less "knowledge" than white college dropouts;† (2) a discrimination in wages with the effect that nonwhites are paid less for the same work than are whites; (3) a discrimination in hiring so that nonwhites are forced to work at jobs requiring less skill (and paying lower wages) than their training might allow.

To the extent that pure wage discrimination exists, and nonwhites receive lower wages for performing the same job, the employers are making extra profits. There is little overall loss in productivity to the economy;

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* This estimate is based on a rough extrapolation of the benefit table for discount rates above 10%.

† The question of the school achievement of nonwhite students as compared to whites is discussed in Chapter III in this report.

there is a transfer "payment" from the nonwhite worker to the (typically white) employer.*

The situation changes when the discrimination takes the form of forcing nonwhites to take jobs below those for which they are qualified. In this case, productive capacity in the economy is being wasted, and the total product of the economy is lower than it would be if the labor were used more efficiently. A partial analysis of the extent to which this variety of discrimination exists can be carried out on the basis of the Census data on occupation, education, and earnings. That discussion is taken up in the next section of this paper.

From the point of view of the economy, education is a process which adds to the productive capacity of the labor force. If employed members of the labor force are paid wages equal to their marginal productivity, then differences in wage rates reflect differences in productivity; it also follows that differences in wage rates due to education will be a measure of the contribution of education toward productivity. The average earnings presented above (Tables 25 to 30) do not reflect average wage rates, but reflect average earnings which include effects of wage rates and of unemployment. The average wage rates can be estimated by considering average earnings for members of the labor force who were fully employed during the year 1959.†

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* "The Economics of Discrimination," by Gary Becker, University of Chicago Press, 1957, discusses these and other related points. That book is reviewed and some additional analysis is provided in the October 1963 issue of the Journal of Political Economy in an article (with the same title) written by Anne Krueger.

† Data for the fully employed portion of the labor force are not available from the published documents of the Census. Those data have therefore been computed from the one-in-a-thousand sample taken by the Census and made available by the Census. Persons who worked 50-52 weeks in 1959 are considered to be fully employed.

Average earnings for the entire male experienced civilian labor force as computed from the one-in-a-thousand sample are also shown at this point. Those averages differ considerably from the published data; any comparisons made between the entire male civilian experienced labor force and other figures computed from the one-in-a-thousand sample should be made with the one-in-a-thousand estimates.

Appendix A to this document explains how the estimates were computed from the sample by the Census and from the one-in-a-thousand sample by SRI.

In the presence of discrimination, it can be argued that nonwhite wages do not represent productivity. If nonwhites are being paid less than whites for doing the same work, then a portion of their productivity is being kept by the employer. If nonwhites are forced into lower paying (and less productive) jobs than those for which they are qualified, they may be receiving wages equal to their productivity, but the productivity and the wages are not a measure of the potential productivity which they have acquired through education. In either case, nonwhite benefits and potential benefits from education will be better measured in terms of the earning received by whites in the labor force.

Discrimination is evidenced in both percentage and earnings data: (1) A lower percent of nonwhites than whites are in the higher earning occupations for a given level of education; and (2) Education nonwhites are receiving lower earnings for performing the same jobs as whites.

As for discrimination in terms of percentages, Table 31 shows that for any given level of education, few Negroes are in the relatively high paid managerial, sales, or craft occupations; whereas a relatively high percent are in low paid service and laboring occupations. For example, managers and officials are the highest paid occupations for all levels of education, yet only 5.8% of nonwhites with a college degree go into this field, while 18.7% of whites with college degrees are in managerial work. Assuming that the college educations of whites and nonwhites are qualitatively equivalent, one could argue that the nonwhites are discriminated against and forced into the lower paying jobs; or one could argue that nonwhites seek those jobs, and becuase of discrimination they are paid less. The former argument seems the more reasonable.

As for discrimination in terms of earnings, nonwhite and white incomes are shown in Table 31. Then from Table 32 the average variance is computed, as shown in Table 33, for income within an educational level when occupation is varied, and within an occupation when educational level is varied. (Farming occupations for which there are no nonwhite data are omitted from the computation, as is "occupation not reported.")

Table 31

MALE EXPERIENCED CIVILIAN LABOR FORCE WITH EARNINGS IN 1959--
DISTRIBUTIONS BY EDUCATION AND OCCUPATION

DISTRIBUTION OF EDUCATIONAL LEVEL BY OCCUPATION	WHITE						NONWHITE					
					COLLEGE						COLLEGE	
	0-7	8	9-11	12	1-3	4+	0-7	8	9-11	12	1-3	4+
PROFESSIONAL, TECH. ETC	0.74	1.35	3.06	7.05	19.81	56.97	0.33	0.93	1.24	3.43	12.88	60.87
FARMERS AND FARM MAN.	7.59	9.23	3.88	4.96	2.71	1.01	6.10	2.08	1.40	1.72	0.00	0.00
MANAGERS, OFFICIALS,ETC.	5.12	7.43	10.52	14.92	22.64	18.73	1.39	1.85	2.02	3.65	6.75	5.80
CLERICAL AND KINDRED	2.52	4.18	6.56	9.81	11.03	5.18	1.39	3.01	6.07	11.80	17.18	10.14
SALES WORKERS	2.43	3.61	5.92	8.68	13.22	8.65	0.46	0.93	1.24	2.58	3.07	2.17
CRAFTSMEN, FOREMEN,ETC	23.88	27.29	28.93	25.27	14.42	4.09	9.48	12.73	13.22	13.95	12.27	3.62
OPERATIVES	30.08	27.55	25.67	17.12	7.49	1.30	24.93	28.94	28.93	24.25	15.95	2.90
SERVICE WORKERS	6.77	6.10	5.50	4.61	3.27	0.75	12.14	15.74	15.55	15.45	12.88	4.35
FARM LABORERS	4.91	1.90	0.93	0.62	0.34	0.16	9.81	3.24	1.87	1.07	0.00	0.00
LABORERS EXCEPT FARM	11.64	7.58	5.10	3.04	1.36	0.28	26.79	20.83	18.35	12.02	6.13	1.45
OCCUPATION NOT REPORTED	4.32	3.77	3.87	3.90	3.82	2.95	6.76	8.80	9.64	9.66	8.59	7.25

DISTRIBUTION OF OCCUPATION BY EDUCATIONAL LEVEL												
TOTAL POPULATION	15.61	16.51	20.77	25.43	9.91	11.78	45.01	12.90	19.19	13.91	4.87	4.12
PROFESSIONAL, TECH. ETC	1.01	1.95	5.55	15.66	17.16	58.67	3.62	2.90	5.80	11.59	15.22	60.87
FARMERS AND FARM MAN.	22.95	29.51	15.61	24.42	5.20	2.31	77.97	7.63	7.63	6.78	0.00	0.00
MANAGERS, OFFICIALS,ETC.	6.42	9.85	17.54	30.46	18.01	17.72	26.92	10.26	16.67	21.79	14.10	10.26
CLERICAL AND KINDRED	5.93	10.39	20.50	37.55	16.45	9.19	12.35	7.65	22.94	32.35	16.47	8.24
SALES WORKERS	5.62	8.63	18.25	32.74	19.43	15.13	17.95	10.26	20.51	30.77	12.82	7.69
CRAFTSMEN, FOREMEN,ETC	16.51	19.96	26.01	28.46	6.33	2.14	38.34	14.75	22.79	17.43	5.36	1.34
OPERATIVES	23.69	22.95	26.89	21.96	3.74	0.77	45.30	15.06	22.41	13.61	3.13	0.48
SERVICE WORKERS	22.05	21.03	23.84	24.47	6.76	1.85	40.67	15.11	22.22	16.00	4.67	1.33
FARM LABORERS	51.65	21.19	12.96	10.70	2.26	1.23	82.68	7.82	6.70	2.79	0.00	0.00
LABORERS EXCEPT FARM	35.84	24.70	20.90	15.24	2.65	0.66	59.41	13.24	17.35	8.24	1.47	0.29
OCCUPATION NOT REPORTED	17.67	16.31	21.02	25.96	9.91	9.11	37.64	14.02	22.88	16.61	5.17	3.69

Table 32

1959 MEAN INCOME
(Thousands of Dollars)

EARNINGS	WHITE						NONWHITE					
					COLLEGE						COLLEGE	
	0-7	8	9-11	12	1-3	4+	0-7	8	9-11	12	1-3	4+
TOTAL POPULATION	3.98	4.84	5.56	6.25	7.55	10.24	2.56	3.32	3.52	4.02	4.36	5.6
PROFESSIONAL. TECH. ETC	5.43	6.11	6.80	7.16	7.51	10.15	2.92	3.39	3.96	5.16	4.93	6.1
FARMERS AND FARM MAN.	2.47	3.23	3.78	4.23	5.44	6.91	1.11	1.98	2.51	4.24	0.00	0.0
MANAGERS. OFFICIALS.ETC.	6.09	7.21	7.94	8.79	10.70	13.49	3.36	4.49	4.74	5.62	5.68	6.5
CLERICAL AND KINDRED	4.49	4.90	5.24	5.52	5.70	6.55	3.43	3.88	4.16	4.47	4.60	4.9
SALES WORKERS	4.50	5.43	6.13	6.83	7.93	9.39	2.76	3.59	3.94	4.65	4.82	5.3
CRAFTSMEN. FOREMEN.ETC	4.62	5.30	5.73	6.14	6.48	8.22	3.12	3.83	3.97	4.49	4.49	5.1
OPERATIVES	4.11	4.76	5.09	5.37	5.59	6.00	2.99	3.59	3.72	3.99	4.15	4.1
SERVICE WORKERS	3.36	3.93	4.43	4.95	5.06	5.56	2.62	2.93	3.04	3.29	3.47	3.6
FARM LABORERS	1.72	2.37	2.80	3.26	3.77	4.87	1.18	1.48	1.65	2.35	0.00	0.0
LABORERS EXCEPT FARM	3.29	3.92	4.27	4.60	4.64	5.11	2.53	3.09	3.14	3.43	3.43	3.7
OCCUPATION NOT REPORTED	4.37	4.96	5.40	6.19	7.15	9.08	3.17	3.53	3.61	3.85	4.35	4.7

(NONWHITE EARNINGS)/(WHITE EARNINGS)						
TOTAL POPULATION	0.64	0.69	0.63	0.64	0.58	0.55
PROFESSIONAL. TECH. ETC	0.54	0.56	0.58	0.72	0.66	0.61
FARMERS AND FARM MAN.	0.45	0.61	0.66	1.00	0.00	0.00
MANAGERS. OFFICIALS.ETC.	0.55	0.62	0.60	0.64	0.53	0.48
CLERICAL AND KINDRED	0.76	0.79	0.79	0.81	0.81	0.75
SALES WORKERS	0.61	0.66	0.64	0.68	0.61	0.56
CRAFTSMEN. FOREMEN.ETC	0.68	0.72	0.69	0.73	0.69	0.63
OPERATIVES	0.73	0.75	0.73	0.74	0.74	0.69
SERVICE WORKERS	0.78	0.75	0.69	0.66	0.69	0.65
FARM LABORERS	0.69	0.62	0.59	0.72	0.00	0.00
LABORERS EXCEPT FARM	0.77	0.79	0.74	0.75	0.74	0.73
OCCUPATION NOT REPORTED	0.73	0.71	0.67	0.62	0.61	0.53

Table 33

VARIANCES IN EARNINGS, WHITE AND NONWHITE
(Thousands of Dollars)

	Variance Between Education Levels	Variance Between Occupations
White	2.16	2.59
Nonwhite	0.58	0.44

The variance for occupation is about the same as the variance for education level. The only possibly significant differences in variance are those between white and nonwhite, indicating that the return to additional education is much lower for nonwhites than for whites.

Table 32 shows nonwhite earnings divided by white earnings for each occupation and educational level, thereby showing the relative discrimination in the form of lower wages for similar work. The discrimination manifests itself in all occupations and all levels of education, but seems somewhat worse for the higher levels of education. These tables show that the lower return to education for nonwhites is comprised both of transfer payments to whites in the form of low wages for similar work, and in the form of entrance barriers to high earning occupations.* In the cost-benefit model, the effects of discrimination are taken into account by using white earnings to measure the benefits of nonwhite education. This measures both the value of the transfer payment (i.e., benefits of Negro education derived by others) and the potential benefits from removal of discriminatory entry conditions.

Full-Time Earnings and Unemployment Rates as Measures of Benefit

The appropriate measure of private benefits is the average earnings of the fully employed times an involuntary unemployment rate. Because of voluntary unemployment, the above computation of benefits will not equal average earnings of the entire labor force. It is assumed in this calculation that persons who are not at work out of choice could join the labor force and enjoy the same average wages and probability of being employed as those who are currently in the labor force and who have the same characteristics.

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* The subject of discrimination will be analyzed more fully in the final report.

In the following tables, Tables 34-37, benefits from education by sex for the entire experienced civilian labor force may be compared with benefits to the fully employed whites. Note that the benefits from education are lower for the fully employed than for the entire labor force. This is an indication that part of the benefits from education are reflected in differential rates of involuntary unemployment.*

The Committee for Economic Development (CED) in a statement on "Raising Low Incomes Through Improved Education," says that: "People with low education suffer much more unemployment, on the average, than people with higher education."† The data the CED used was from the Monthly Labor Review‡ and are reproduced here.

The CED statement is certainly true for the white males shown in Table 38. For all age groups in both 1964 and 1962, the unemployment rate decreased monotonically as a function of education. For nonwhites and for females, the situation is not clearcut. In most cases, the unemployment

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* These benefit differentials decline as the level of education increases, reflecting declining unemployment rates as education increases. The actual differences in benefits due to unemployment rates is greater than shown in the tables, because the data on the labor force combine white and nonwhite workers, whereas the data on the fully employed are for whites only. Since the benefits from education, especially higher education, are greater for whites than for nonwhites, as previously noted, the benefits shown for the entire labor force, combining whites and nonwhites, are less than for whites only; thus, if the entire labor force data were for whites only, the differences between the benefits for the entire labor force and the fully employed would be greater. The data source was such as to preclude making the fully appropriate comparisons at this time.

† A statement by the Research and Policy Committee, September 1965, p. 16.

‡ Monthly Labor Review, May 1965, p. 521.

Table 34

WHITE MALES FULLY EMPLOYED--DISCOUNTED INCOMES

Discount Rate	Years of Education 0-7	8	9-11	12	1-3 COL	4+COL
-1	247.67	284.82	317.30	365.73	419.96	550.12
0	187.81	214.90	236.73	270.86	308.55	400.29
1	145.58	165.60	180.20	204.66	230.86	296.17
2	115.28	130.26	139.86	157.69	175.83	222.75
3	93.17	104.50	110.60	123.80	136.24	170.21
4	76.76	85.40	89.02	98.93	107.30	132.05
5	64.38	71.01	72.84	80.39	85.82	103.93
6	54.68	60.00	60.53	66.32	69.63	82.91
7	47.47	51.43	51.00	55.49	57.24	66.98
8	41.62	44.68	43.52	47.02	47.64	54.74
9	36.92	39.27	37.57	40.30	40.08	45.22
10	33.09	34.88	32.77	34.89	34.06	37.73

-1	37.15	32.48	48.44	54.23	130.16
0	27.09	21.83	34.13	37.69	91.73
1	20.02	14.59	24.47	26.20	65.31
2	14.98	9.60	17.83	18.15	46.92
3	11.32	6.10	13.20	12.44	33.97
4	8.64	3.62	9.92	8.37	24.75
5	6.64	1.83	7.54	5.43	18.11
6	5.12	0.53	5.80	3.31	13.28
7	3.96	-0.43	4.49	1.75	9.73
8	3.06	-1.15	3.50	0.62	7.10
9	2.35	-1.70	2.73	-0.22	5.14
10	1.79	-2.11	2.12	-0.83	3.66

INCOME DATA FOR SPECIFIC AGES WAS OBTAINED BY
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MORTALITY TABLE TAKEN FROM U.S. EXPERIENCE 1961

PROGRAM WILL NOT ALLOW STARTING AGE GREATER THAN 25

INCOMES ARE DISCOUNTED BACK TO AGE 14

Table 35

MALE CIVILIAN LABOR FORCE--DISCOUNTED INCOMES
(From 1/1000 Sample)

Discount Rate	0-7	8	9-11	12	1-3 COL	4+COL
		Years of Education				
-1	190.30	240.88	281.09	333.45	385.29	522.36
0	142.60	179.78	209.22	246.90	282.55	379.00
1	108.97	136.74	158.67	186.30	210.76	279.42
2	84.89	105.92	122.55	143.19	159.85	209.24
3	67.35	83.50	96.32	112.01	123.19	159.07
4	54.37	66.93	76.96	89.11	96.41	122.70
5	44.61	54.50	62.44	72.00	76.55	95.96
6	37.15	45.02	51.39	59.03	61.62	76.03
7	31.37	37.68	42.86	49.05	50.23	60.98
8	26.82	31.93	36.17	41.25	41.43	49.47
9	23.19	27.36	30.85	35.08	34.54	40.56
10	20.26	23.68	26.58	30.13	29.08	33.58

-1	50.58	40.21	52.35	51.84	137.07
0	37.19	29.44	37.68	35.66	96.45
1	27.76	21.94	27.63	24.46	68.65
2	21.03	16.63	20.64	16.66	49.39
3	16.15	12.82	15.70	11.18	35.88
4	12.57	10.02	12.15	7.30	26.29
5	9.89	7.95	9.56	4.55	19.41
6	7.87	6.38	7.64	2.59	14.41
7	6.32	5.17	6.19	1.18	10.75
8	5.11	4.23	5.08	0.18	8.04
9	4.17	3.50	4.23	-0.54	6.02
10	3.42	2.91	3.55	-1.05	4.49

INCOME DATA FOR SPECIFIC AGES WAS OBTAINED BY
INTERPOLATION FROM DATA GIVEN FOR SELECTED AGES
ALL INTERPOLATION USED WAS LINEAR

MORTALITY TABLE TAKEN FROM U.S. EXPERIENCE 1961

PROGRAM WILL NOT ALLOW STARTING AGE GREATER THAN 23

INCOMES ARE DISCOUNTED BACK TO AGE 14

Table 36

WHITE FEMALES FULLY EMPLOYED--DISCOUNTED INCOMES

Years of Education

Discount Rate	0-7	8	9-11	12	1-3 COL	4+COL
-1	162.43	162.91	177.38	197.38	216.01	273.83
0	126.85	125.38	134.35	149.19	161.25	202.10
1	101.49	98.81	103.94	115.08	122.68	151.88
2	83.07	79.66	82.08	90.52	95.06	116.15
3	69.45	65.61	66.08	72.52	74.95	90.31
4	59.17	55.11	54.17	59.11	60.06	71.33
5	51.29	47.13	45.16	48.94	48.85	57.16
6	45.12	40.96	38.21	41.10	40.28	46.42
7	40.23	36.11	32.78	34.97	33.63	38.16
8	36.28	32.23	28.47	30.10	28.40	31.72
9	33.04	29.09	24.99	26.17	24.22	26.62
10	30.35	26.50	22.16	22.97	20.85	22.55

-1	0.48	14.47	20.00	18.63	57.82
0	-1.47	8.97	14.84	12.06	40.85
1	-2.68	5.13	11.14	7.60	29.20
2	-3.42	2.42	8.44	4.54	21.09
3	-3.84	0.48	6.44	2.43	15.37
4	-4.06	-0.94	4.93	0.95	11.27
5	-4.15	-1.98	3.78	-0.09	8.31
6	-4.16	-2.75	2.89	-0.82	6.14
7	-4.12	-3.33	2.19	-1.34	4.53
8	-4.05	-3.76	1.63	-1.70	3.32
9	-3.95	-4.09	1.18	-1.95	2.40
10	-3.85	-4.35	0.81	-2.13	1.71

INCOME DATA FOR SPECIFIC AGES WAS OBTAINED BY
INTERPOLATION FROM DATA GIVEN FOR SELECTED AGES
ALL INTERPOLATION USED WAS LINEAR

MORTALITY TABLE TAKEN FROM U.S. EXPERIENCE 1961

PROGRAM WILL NOT ALLOW STARTING AGE GREATER THAN 23

INCOMES ARE DISCOUNTED BACK TO AGE 14

Table 37

FEMALE CIVILIAN LABOR FORCE--DISCOUNTED INCOMES

Discount Rate	Years of Education 0-7	8	9-11	12	1-3 COL	4+COL
-1	93.18	109.98	126.02	157.74	172.01	225.26
0	70.35	82.58	93.51	118.17	127.22	165.30
1	54.29	63.31	70.76	90.35	95.89	123.48
2	42.81	49.53	54.58	70.45	73.62	93.85
3	34.45	39.52	42.88	55.96	57.52	72.51
4	28.26	32.13	34.29	45.25	45.69	56.91
5	23.60	26.58	27.87	37.18	36.86	45.33
6	20.03	22.34	23.00	31.01	30.16	36.60
7	17.26	19.06	19.25	26.21	25.00	29.92
8	15.06	16.48	16.32	22.42	20.97	24.74
9	13.31	14.43	14.00	19.39	17.78	20.67
10	11.88	12.77	12.13	16.94	15.22	17.43

-1	16.79	16.05	31.71	14.28	53.24
0	12.23	10.94	24.66	9.05	38.08
1	9.01	7.46	19.59	5.54	27.59
2	6.72	5.05	15.86	3.17	20.23
3	5.07	3.36	13.08	1.55	15.00
4	3.87	2.16	10.96	0.44	11.23
5	2.97	1.29	9.31	-0.32	8.47
6	2.31	0.66	8.01	-0.85	6.44
7	1.80	0.19	6.96	-1.21	4.92
8	1.42	-0.16	6.10	-1.45	3.77
9	1.12	-0.43	5.40	-1.61	2.89
10	0.89	-0.64	4.81	-1.72	2.21

INCOME DATA FOR SPECIFIC AGES WAS OBTAINED BY
INTERPOLATION FROM DATA GIVEN FOR SELECTED AGES
ALL INTERPOLATION USED WAS LINEAR

MORTALITY TABLE TAKEN FROM U.S. EXPERIENCE 1961

PROGRAM WILL NOT ALLOW STARTING AGE GREATER THAN 23

INCOMES ARE DISCOUNTED BACK TO AGE 14

Table 38

UNEMPLOYMENT RATES

	March 1964			March 1962		
Age, Sex, Race	Grades 0-8	Grades 9-11	Grades 12+	Grades 0-8	Grades 9-11	Grades 12+
Age 18-24						
White male	19.4	11.3	8.8	18.6	15.3	8.5
White female	16.0	17.0	6.6	17.4	17.3	7.0
Nonwhite male	16.3	22.0	8.8	19.2	23.4	12.7
Nonwhite female	--	31.9	23.2	--	26.7	19.2
Age 25-34						
White male	9.0	4.5	2.4	9.8	6.5	3.3
White female	7.8	7.4	5.6	8.4	9.2	4.3
Nonwhite male	12.7	11.5	6.9	7.5	19.2	8.0
Nonwhite female	12.8	13.5	9.6	13.6	15.4	9.2
Age 35-44						
White male	6.8	5.1	1.8	6.9	5.7	2.1
White female	10.6	7.4	3.2	6.7	7.5	3.5
Nonwhite male	10.3	4.6	8.5	13.4	14.1	9.9
Nonwhite female	9.2	8.4	3.6	10.0	10.2	6.8
Age 45 or older						
White male	6.1	5.1	2.4	6.4	4.4	2.6
White female	5.3	3.9	3.3	5.0	5.1	2.2
Nonwhite male	7.5	7.8	6.3	13.0	8.6	8.0
Nonwhite female	6.7	7.3	3.8	5.1	5.1	9.3
All ages						
White male	7.2	5.9	3.2	7.5	6.7	3.5
White female	7.1	7.3	4.5	6.2	8.3	4.0
Nonwhite male	9.6	11.3	7.6	12.8	16.6	9.5
Nonwhite female	8.9	14.4	10.2	9.6	13.6	11.7

rate for nonwhites was higher among high school dropouts than among those with 9 years of education.* This phenomenon could be explained if it were the case that people with less than 9 years of education take unskilled jobs or become apprentices at skilled jobs, or go to trade schools at the time others are going to high school, and that the seniority the dropouts build up is sufficient to keep them on the job when others are laid off. Alternatively, nonwhites with 0-8 years of education may be more rural than those with 9-11 years and do farm work where the problem tends to be underemployment rather than unemployment.

As is the case with earnings, the data show a large differential between whites and nonwhites. In the data for males, with all ages combined, the unemployment rate for the most educated nonwhites is higher than the rate for whites with less than 9 years of school; it is also more than twice the rate for whites with 12 years of schooling. The data also show, however, that a high school education is even more useful to nonwhites than to whites in reducing total unemployment.

Previous tables (Tables 33 and 34) for females show that benefits among fully employed females as a result of grammar school graduation are negative (this could be merely a result of statistical errors in a small sample), but that at the college levels, the benefits for the fully employed females approach the benefits for the entire labor force, as was the case with the males. Both the earnings levels and the benefit levels are lower for females than for males. In the total female force, some of the difference is undoubtedly due to the relatively large number of females who do not work full time for the whole year; some of this effect will also be present in the fully employed data as the result of females who chose to work only a portion of the week.

When the effects of part-time work are eliminated, it will still turn out that women's wages are lower, on the average, than are men's. There is considerable debate as to whether this is due to discrimination against females in the labor market or due to certain characteristics of women which makes them less productive members of the labor force. That debate will not be joined here.

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* In one case, nonwhite males 35-44, the rate was lowest among high school dropouts. This case would appear to be an error on the part of the Monthly Labor Review.

The Discount Rate (d)

The critical decision variable in public policy is the cost-benefit ratio and indeed, most public investment decisions are supposed to be made on the basis of such a ratio. Unfortunately, most investments involve a stream of expenditures and revenues spread over time. Thus, in order to compute the cost-benefit ratio, one has to compute the present value of these streams, and the cost-benefits ratio is really the ratio between the present value of cost and the present value of benefits. Therefore, any decision regarding the cost-benefits ratio must implicitly assume some discount factor to be applied to the future stream.

If the cost-benefit ratio is relatively insensitive to the discount factor, we probably would regard the choice of the discount factor as a secondary problem. This is unfortunately not the case. Consider the following example: an investment of $1 million is expected to yield an annual stream of $50,000. The following table presents the relationship between the discount factor and the ratio for this investment:

Discount Rate	Cost-Benefit Ratio
2%	2.50
3	1.67
4	1.25
5	1.00
6	0.83
7	0.71
8	0.63
9	0.55
10	0.50

It is clear that the selection of the discount rate will govern the investment decision.

It is not our purpose here to come up with a number which we would regard as "the" appropriate discount rate for our projects. What we do aim to do is to clarify the outstanding analytical questions in order to set the stage for the procedure which we shall employ. The discount rate to be employed in this study has three components: (1) the rate of time preference; (2) the rate of productivity increase; and (3) the elasticity of earnings with respect to education. Each will be discussed below.

The Rate of Time Preference

The Private Rate of Time Preference. In this study we shall consider stream of benefits B(t) over time and we hope to compute its present value:

$$B = \int_{0}^{\infty} e^{-\rho t} B(t)\, dt$$

where ρ is the rate of time preference. Although we shall primarily be interested in private benefits of projects in education, it will be clear that some of the benefits studied will be social. Thus the immediate question arises: should the ρ be the private discount rate or the social discount rate?

Suppose for a moment that the stream of benefits $B(t)$ is a stream of private benefits; then if we take ρ to be the private discount rate, B will measure the private present value of the stream. Now notice that individuals always have the option of undertaking investment projects and computing their present value on the basis of their private rate of discount. If this present value is greater than the cost, then individuals will undertake the projects. Thus there is a revealed behavior which may provide some information regarding the private discount rate. This revealed behavior is the unwillingness of individuals to undertake educational projects themselves but rather to apply pressure on the public sector to provide increasing amounts of education. This pressure on the public sector implies that individuals either "can't," because they may not have the capital, implying that the capital market is not perfect; or they do not want to, implying that their discount rate is indeed high.

In either case, we have the revealed behavior that individuals do not undertake these projects. This behavior could either reflect a private discount rate that is "too high," or private benefits that are too small compared with the cost. In the latter situation, the reason for private rejection is mostly the small size of the benefits, rather than the discount rate. Since, however, we have shown above that private benefits from education are more than adequate to justify the costs, and since individuals do reveal a strong desire for education in their social pretenses, we may conclude that the behavior reflects a "too high" discount rate, rather than too low benefits. There are two major reasons for the private discount rate to be high relative to the social discount rate.

1. Society as a totality seems to have preferences which are different from the individual preferences. Although every individual lives for a finite length of time, society continues indefinitely, and in our social behavior we seem to indicate that we derive some benefits from increased welfare of future generations. Thus, together we are concerned to some extent with what the next generation "will think of us" and we are certainly concerned with the general complexion of the society as a whole. We derive joint benefits from the mere fact that our society is "doing well" and the next generation is expected to be materially better off. All these facts add up to the hypothesis that our social evaluation of future benefits is greater than our private evaluation of our future benefits, i.e., the social discount factor is lower than our private discount rate.
2. There are externalities since education is not only a private good but also a public good which produces a great many benefits not included in the individual's calculations of the present value of benefits, for example, technological progress due to education, reduced crime, etc. Thus, when we say that the present value of the private benefits is insufficient to justify

the individual investment, it may still be true that (with the same discount rate) the present value of social benefits will justify the project.

In this project we are concerned with social policy--regardless of which benefits we estimate--and hence, we are concerned with the present social value of benefits. Since in this work we estimate private benefits primarily (and only partly the additional benefits which are regarded as non-private or social), it is necessary, because of social policy, for us to discount these benefits with the social rate of discount and not the private rate. This is the way we obtain the present social valuation of the stream of benefits which we estimate. We note that if $B_1(t)$ is the stream of private benefits, $B_2(t)$ is the stream of non-private benefits. Then we have

$$\int e^{-t} B(t)dt = \int e^{-t} B_1(t)dt + \int e^{-t} B_2(t)dt$$

and both private and non-private benefits are evaluated at their social rate of discount. This amounts to calculating the social valuation of private and non-private benefits.

We have argued above that there is ground to the belief that social and private discount rates are different. But in order to compute the present value, we need some "number" for the social rate of discount.

The Social Rate of Time Discounting. Earlier, we observed that society in its aggregate will conceivably have a different marginal rate of substitution between today's benefits and tomorrow's benefits than an individual. Thus, society's evaluation of future benefits is less myopic than any random individual's. As noted above, this may be the result of many causes but it would be reflected in the investment behavior of the public versus the private sector. Indeed, there are those who argue that in social planning, today's generation and tomorrow's generation ought to be "equally" treated, i.e., the social discount rate should be zero.* Part of the reason for this position follows from the argument that in the long run, all generations "own" the society and thus all generations ought to have a say in its decisions regarding the use of the resources. Unfortunately, there is no way in which the future generations can vote since they are not here to vote. However, had they been here to vote, they would demand equal treatment; thus we ought not to discount the future against them.

First, if we could allow future generations to vote on their destiny, there will be so many more of them, they might just vote that we today should save and invest everything for them!! Thus an equal vote for all future generations may lead to the paradoxical result that we should give up all pleasures in life so that they can be better off. Second, technological change and rising productivity will make the future generation richer than we are. Thus the poor is to give up his welfare in favor of the rich!!

These two paradoxes indicate two main conclusions:

1. The revealed social behavior is that we are actually not willing to allow future generations to outweigh our vote. Thus the hypothesis of "equal vote" is empirically unprovable.
2. Since productivity will raise future wealth, then a procedure which will not discriminate against the present generation will call for a social discount rate at least equal to the rate of productivity increase.

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* Although it is not possible to find an exact source of this idea, it does go through the entire literature on optimal planning.

This reasoning suggests that the social discount rate should be at least equal to the rate of productivity increase; but in order to examine the possible upper bounds, we must clarify the meaning of the term "private discount rate."

Under perfect competition in all markets, all individuals will adjust their borrowing and lending patterns in such a way that on the margin, they will be indifferent between all alternatives. Thus the market interest rate will be equal to the marginal rate of substitution between consumption today and tomorrow, i.e., the subjective discount rate. Thus in a perfectly competitive economy, the market will reveal to us the marginal private discount rate which will be equal to all individuals. In an imperfect capital market, the situation is different. Since different individuals are confronted with different market interest rates, their equilibrium subjective rates of discount are different. In practice, then, there exists a whole spectrum of private discount rates rather than one.

For this reason, it has been suggested that we consider the sources of funds used in social investments,* as the discount rate will vary depending on how the government acquires its revenue. Had the government optimized over its fiscal resources, we would expect the marginal cost of all sources to be equal. But this is unlikely to be the case, since the government imposes taxes and raises other resources on criteria which are not necessarily consistent with the principle of "equal marginal burden."

Using a discount rate that represents the weighted average of the private rates in each alternative use makes sense only in an imperfect capital market, where individuals face different interest rates. But the very fact that the capital market is imperfect means that the amount of total investments will be less than the rate of investment that would prevail under a perfect capital market. Thus if society uses this method to calculate the social discount rate it may be computing a rate which is "too high"--i.e., a rate that leads to less investment than that which would have prevailed under competitive conditions.

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* See, for example, Eckstein (211) and Krutilla (213).

Moreover, we have argued above that even under competitive circumstances, the social discount rate is less than the individual discount rate. The implication that the market rate leads to less than optimal investment is that the social discount rate requires more social investments than are currently undertaken. In practice, this means that individual investors are evaluating future streams of benefits at a discount rate which is too high compared with the socially desirable rate. Thus, whatever the "private discount rate" is, it is higher than the social discount rate.*

The Practical Procedure. Unfortunately, the conceptual problems associated with the determination of the social discount factor are very deep. It can be argued, however, that the social rate of discount ought to be found somewhere between the rate of productivity and the private, alternative cost discount rate.

In reality, it is not the economist but rather the decision-maker in public position who must decide on the rate of social discount. This decision-maker may form his evaluation of future benefits on the basis of a democratic vote or any other social procedure. Having determined its discount rate, society ought to proceed and invest at such a rate that will equate the marginal rate of social return to the discount rate.

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* See, however, the discussion between Marglin (215) (216) and Lind (214) and Tullock (218).

The economist can only investigate those projects which may conceivably be relevant to the decision-maker. For this reason, one should hope that the results of the research will be in the form of curves which indicate--for each project--the cost-benefit ratio for alternative discount rates ranging from the rate of social productivity to the private, alternative cost, rate of discount. On the basis of such curves, a decision-maker can evaluate the cost-benefit ratio which is appropriate to his discount rate.

Trends in Productivity as a Factor in Earnings Growth

The rate of productivity increase, regarded above as the lower bound on the social discount factor, is also a measure of the potential growth in earnings for each age group. The distribution of earnings for each age group will shift over time precisely at the rate of productivity increase over time. In our discussion below (see section on elasticities), we shall present a more comprehensive discussion of this earning distribution. Here we shall address ourselves only to the question of the rate of productivity increase, both as a lower bound for the rate of social discount and as a basis for our projection of earnings.

Recent work by economists has produced the following results:

1. The rate of productivity increases in the United States has been dominated by the effect of technological change. Thus, during the period 1920-1960, total output has grown at the annual rate of 3.3%. To this, the growth of the labor force has contributed 0.98%, the growth of the capital stock 0.34%, and technological change 1.48%.* During the period after World War II, the rate of technological change increased to 1.92%, and in the 1960s is increasing so sharply as to attain boom proportions.

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* Reference 210.

2. The net effect on wages can be measured in terms of growth of output/labor ratio. Thus, output per man-hour has grown during the period 1920-1960 at the annual average rate of 1.9%. During the period 1960-1965 this growth rate has been 3.5%.

Beyond these basic estimates, there has been a significant amount of work devoted to explaining the rate of technological improvements. Two particular works are significant: One is Denison[210] and the other is Griliches.[212] These works have followed the pioneering work of Schultz in the field of investments in human capital, by applying the analysis to the explanation of productivity increases. In essence, they have claimed that some 50-60% of the so-called "rate of technological improvement" has been the result of increased level of education. This result is controversial and we shall not enter this discussion. We do point out the fact that the externalities of education, as explained earlier, are reflected in the faster growth rate for the economy as a whole.

From our standpoint, the relevant question here is--what should we accept as the "best" projected rate of productivity increases over the coming decade? It seems that the experience of the 1960s would probably yield an upward biased estimate since it is hard to believe that the U.S. economy can sustain a growth rate of such proportions over a very long period. At the same time, the 1.9% annual rate of increased output per man-hour for the period 1920-1960, seems to provide too conservative an estimate of the growth rate since it includes the years of the 1930-38 depression and a rather slow growth rate in the 1950s. But, note that if we are to decide on any "number" as a projected productivity rate, it will be arbitrary. If, however, we compare projections made by institutions like NPA, Committee for Economic Development, Resources for the Future, Twentieth Century Fund, or various government agencies, we often find projections based on the rate of productivity increases from 2.7% to 3%. As a basic decision, we can very reasonably assume output per man-hour to grow at an average rate of 2.85% per year. Part of the increase, however, reflects the gains from an increase in the educational level of the labor force. To the extent that this gain is captured by the individual, it is incorporated in the benefit stream and should not also be contained in the productivity growth factor. The amount so captured is probably less than the estimate of education's contribution to growth by Denison (0.6%), but how much less depends on the relationship between private and social benefits to education. If we accept a value of 0.3%, then the net productivity rate would be about 2.5% per year.

The Elasticity of Earnings with Respect to Levels of Education

The economic benefits of education accrue to individuals and society over a long period of time. In order to properly evaluate these benefits, our estimate of future earnings should take into account expected changes in the level of wages and rates of unemployment. Basically, these rates will be influenced by changes in labor productivity and by shifts in supply and demand functions that result in a change in the equilibrium level of wages.* For example, if the education system is producing high school graduates in numbers that differ from what the market can absorb at present wage levels, then high school graduates will experience changes in wage levels, changes in level of unemployment, or both.

In this section, relative changes in supply and demand will be analyzed, and appropriate adjustment will be made of the lifetime earning streams to accommodate shifts in equilibrium conditions. As will be demonstrated later, the projected effects on earnings, from relative shifts in supply and demand for different levels of education, can be incorporated into the cost-benefit model by asjustment of the discount rate.

The supply projections are based on extrapolation of recent trends in educational attainment and labor force participation rates as well as on projected population growth. These projections are made exogenously of the demand analysis, and supply is assumed to be perfectly inelastic with respect to wages. Thus, the analysis is meant to show the effects on wages and employment _if_ current trends in educational attainment are continued; they would therefore be suggestive of policy with regard to shifts in these trends. The methodology and data used to project labor supply by level of education is presented in Appendix A.

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* The estimates of lifetime earnings in the section above, and in the standard works in the field, use cross-sectional data, which are biased because of their failure to incorporate these trends. See Reference 175.

From 1965 to 1975, the male labor force is projected to increase as follows:

Education Level (Grade)	Percent Increase
0-11	+05%
12	+23
13-15	+45
16	+47
17+	+50
Total Male Labor Force	+20%

These trends show a relatively more rapid increase in those with college training and a relatively smaller increase in the number of males with less than a high school diploma. Despite the smaller percentage increase, there are expected to be 1.2 million more males in the labor force in 1975 without high school diplomas than in 1965, if current trends continue.

Because of increasing labor force participation, the female labor force will grow more rapidly than the male labor force:

Education Level	Percent Increase
0-11	+13%
12	+36
13-15	+50
16	+47
17+	+17
Total Female Labor Force	+27%

The percent of females with less than a high school diploma will increase more slowly than the total, but relatively more rapidly than their male counterparts. The very small extent of female entrance into graduate schools accounts for a relatively small growth in the female labor force with 17+ years of schooling.

Job Opportunities and Educational Requirements. Basic to the projection of demand for labor with varying education is the concept that there is a high positive correlation between an occupation and the amount of education and training required to perform the tasks that comprise the work of that occupation. Thus, an uneducated, untrained individual can generally not be expected to perform the tasks required to be a metalsmith, a college professor, or a dentist. On the other hand, the correlation is far from perfect because a given occupation contains persons with various levels of education, and furthermore there is a degree of substitutability between general education, formal vocational education, and on-the-job training. We shall demonstrate below that the present situation is one reasonably close to a demand equilibrium and that one can project the demands for education level as a function of industrial and occupational requirements.

Past work on educational requirements shows that there is a strong correlation between requirement and attainment. The Department of Labor has made a very impressive compilation of information on educational and training requirements in Estimates of Worker Trait Requirements for 4000 Jobs.[*] This publication lists both specific vocational requirements in terms of months or years of training, and general education requirements in each of the jobs. Using this publication, Eckhaus estimated that in 1950, 67% of the labor force were in jobs that required less than a high school diploma.[†] In another study, a survey was taken of employers in which they were asked to give the minimum level of general education that they would require of applicants for filling positions in their industry. The results of this study provide a distribution of education requirements for the total labor force very similar to that found by Eckhaus. A comparison of the distributions of educational requirements in 1950 with the distribution of attainments as shown in the Census leads to the conclusion that the ablor force was somewhat more highly educated than required for average or minimal performance on the jobs. See Table 39.

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[*] U.S. Department of Labor, Bureau of Employment Security, United States Employment Service.

[†] Reference 162, Table 3, p. 185.

Table 39

EDUCATIONAL REQUIREMENTS AND ATTAINMENT

1950

Years of Schooling	Requirements		Attainment
	(Bell)[*]	(Eckhaus)[†]	(Census)[‡]
0-11	71%	67%	61%
12	20)		(24
	)	25-1/2	(
13-15	2-1/2)		(8
16+	6-1/2	7-1/2	7
	100%	100%	100%

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[*] Reference 125, Table 30, p.346.

[†] Reference 162, Table 3, p. 185.

[‡] 1950 Census of Population, "Occupational Characteristics," Special Report P-E, No. 1B

This table indicates that in general, jobs requiring college degrees were, in fact, being filled by persons with this attainment. At lower levels of requirement, however, some workers had higher levels of attainment than required for the job. Two interpretations are possible: (1) some workers have more education than they need to perform the tasks; or (2) in many occupations, higher levels of education are associated with greater productivity, even though the basic tasks can be performed by persons with less education.[*] If the first hypothesis is correct, it would imply that 6 to 10% of the labor force had more general education than necessary to equate minimal or average requirements with attainments. Taking a Baysean point of view and splitting differences, we may estimate that in 1950 only about 4% of the

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[*] The projection analysis is based on the latter assumption.

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labor force has more education than required for the jobs they are performing. Thus, in 1950, supply of labor by level of education closely approximated the conditions of demand, as represented by requirements. We will assume that this condition also holds true at present, although we do not have updated information on requirements to verify this assumption.

By 1965, the educational attainment of workers had increased significantly, as shown in Table 40, comparing the distributions for 1950, 1960, and 1965.

Table 40

EDUCATIONAL ATTAINMENT OF LABOR FORCE

Years of Schooling		1950*	1960†	1965‡
0-11		61%	54%	41%
12		24	26	36
13-15		8	10	11
16+		7	10	12
	Total	100%	100%	100%

Sources:

* 1950 Census of Population, op. cit.

† 1960 Census of Population, Special Report, PC (2) 5B.

‡ BLS, "Educational Attainment of Workers", March 1965, Special Labor Force Report #65, plus estimate for 14-17 age groups by SRI. See Appendix A.

The significant increase in the level of education of the labor force is reflected in a shift in the composition of demand toward workers with higher levels of education. This shift represents a combination of a change in the occupational distribution toward occupations demanding higher levels of education, primarily the professions, and an upgrading of the educational requirements within broad occupational categories. One investigation of this change concluded that between 1940 and 1960, 85% of the rise in educational attainment may be attributed to increased educational levels within occupations and only 15% to shifts in the occupational structure from occupations requiring less to occupations requiring more education.*

In our study, occupation shifts to 1975 are projected by using the occupational projections of the Department of Labor (see Appendix A). Occupational upgrading is accounted for by extrapolating current trends in educational distribution by occupational category.

Table 41 shows that for males, there will be larger than proportionate growth in demand for professional, sales, and service occupations, with less than proportionate growth in operatives, farming, and laboring occupations. For females, there will be a larger than proportionate growth in professional and service occupations, an absence of growth among farm workers and laborers, and less than proportionate growth for operatives.

In the recent past, the following changes have occurred in the percent distribution by level of education within occupation groups: (1) a rising proportion of workers in each occupation has high school diplomas; (2) a falling proportion has less than a high school education; and (3) a rising proportion of managers have college degrees, mainly because of the professionalization of management. There has been no increase in the proportion of workers having some college but less than a bachelor's degree. The various historical trends are shown in Appendix A.

The projection of the labor force by educational attainment, and job opportunities by educational requirements, are shown for 1970 and 1975 in Table 42. The total job opportunities have been adjusted to represent an overall unemployment rate of 3%. Thus, total job opportunity is assumed to adjust to the total available labor force. The table shows relative supply and demand conditions for educational categories. According to these

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* Reference 165, p.29.

Table 41

PROJECTED JOB OPPORTUNITIES BY SEX AND OCCUPATION (MILLIONS OF JOBS)

	Estimated	Projected		% Change
	1965	1970	1975	1965-75
		MALES		
Professional	5.6	6.7	7.7	+38%
Manager	6.4	6.9	8.0	+25
Clerical	3.3	3.8	4.3	+30
Sales	2.6	3.0	3.5	+35
Craft	8.4	9.8	10.8	+28
Operative	9.4	9.8	10.1	+7
Service	3.3	3.9	4.5	+36
Farm	3.3	3.3	3.3	0
Laboring	3.5	3.5	3.6	+ 3
	45.8	50.4	55.8	+22%
		FEMALES		
Professional	3.4	4.2	4.8	+41
Manager	1.1	1.3	1.4	+27
Clerical	7.7	9.4	10.3	+34
Sales	1.8	2.2	2.4	+33
Craft	.3	0.3	0.4	+33
Operative	3.7	4.1	4.2	+14
Service	6.9	7.1	8.2	+37
Farmer	0.6	0.5	0.4	=33
Laborer	0.1	0.1	0.1	--
	24.7	29.2	32.2	+30%

NOTE: Projected percent distribution by sex according to actual distribution in 1965 is given in the first source. The second and third sourcee provided control totals by occupation.

* U. S. Department of Labor, Bureau of Labor Statistics, Educational Attainment of Workers, Special Labor Force Report No. 65, March 1965, Table 1, Occupation of Employed Persons 18 Years Old and Over, by Sex and Years of School Completed, March 1965.

† U. S. Department of Labor, "Manpower Report of the President," and a Report on Manpower Requirements, Resources, Utilization, and Training, transmitted to the Congress March 1966. - - Table 14, Actual and Projected Employment by Major Occupation Group, 1965 and 1970.

‡ U. S. Department of Labor, Bureau of Labor Statistics, Special Labor Force Report No. 28, Employment Projection by Industry and Occupation, 1960-75, from the Monthly Review, March 1963, Table 2, Employment by Major Occupational Group, 1960 to 1975.

Table 42

SUPPLY AND DEMAND FOR LABOR BY LEVEL OF EDUCATION
1970 and 1975
(Millions of Workers)

1970				1975		
Educ. Level	Labor Force (Supply)	Job Opportunity (Demand)	(D)/(S)	Supply	Demand	D/S
			MALE			
0-11	23.6	20.7	0.877	23.5	21.1	0.898
12	15.7	17.4	1.108	18.4	20.1	1.092
13-15	5.8	5.5	0.948	7.0	6.2	0.886
16	3.9	4.0	1.026	5.0	5.0	1.000
17+	2.8	2.8	1.000	3.6	3.4	0.945
	52.0	50.4		57.5	55.8	
			Female			
0-11	12.0	9.7	0.808	11.9	9.7	0.815
12	12.0	13.3	1.108	14.1	15.6	1.106
13-15	3.3	3.0	0.909	3.9	3.3	0.846
16	2.0	2.2	1.100	2.5	2.6	1.040
1[illegible]+	.8	1.0	1.250	.9	1.15	1.278
	30.2	29.2		33.2	32.2	

Source: Stanford Research Institute. See Appendix A.

projections, there will be considerable excess demand (shortage) for high school graduates both in 1970 and 1975, and excess supply of those with less than a high school education. If these projections are correct, any concern that new programs will "flood the market" with high school graduates would be unwarranted. In fact, the table shows that a shift of approximately 2 million male and 1-1/2 million female workers to the status of high school graduate would be necessary to prevent earning differentials between high school graduates and those with less than a high school education from increasing.

The results with regard to college education are less clear. There appears to be ample demand for the expected supply of college graduates, although the very rapid growth in earnings in recent years may slow; but there is a decided excess supply situation appearing for those with some college but no degree.*

The excess demand or supply for each level of education is transformed into an estimate of earning adjustments, represented by the ratio of demand to supply, that would be necessary to create demand and supply equilibrium in 1975. (See Table 42.) The theoretical issues involved in projecting earnings are discussed below.

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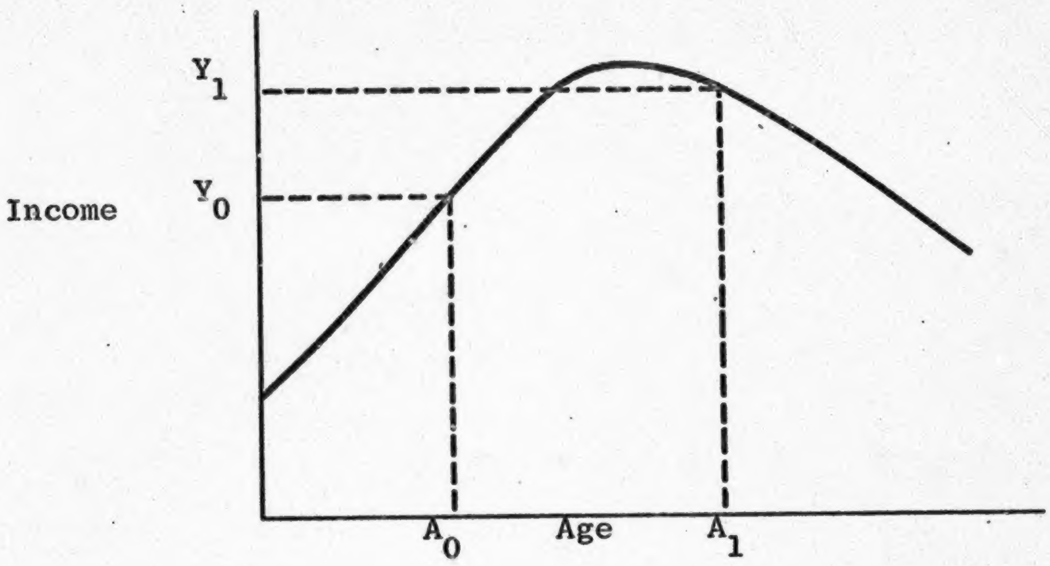
* This extrapolation of past trends may not be valid, since there is currently a shift in content of this kind of education, i.e., away from the college dropout, (the demand for which is not growing fast) toward the two-year vocationally oriented curriculum at the junior college. Since this curriculum could substitute for industry training programs, the future may show greater growth in demand for this level of education than implied in the extrapolation.

Demand Elasticities: Theoretical Issues in Computation. At any moment of time, there exists a distribution of income by education, age, and other characteristics of population. This distribution was described earlier by $Y(\epsilon)$ where $\epsilon = k, a, v, r, s$. Now consider more specifically the distribution of $Y(k,a,v,r,s)$ when K, v, r, and s are held constant and a varies: this gives us the average income level of people of given sex, in a given region, of a given level of education, and a given race but varying age. Thus, for example, white male high school graduates in the east have an income distribution over age with the typical shape as shown in the accompanying graph.



Using cross-sectional information to estimate earnings, we assume that a young man who enters the labor force today at age A_0 will be, at age A_1, in the same relative position within his group as the man whose age is A_1 today. Thus, the income curves represent a stream of income independent of real time. In real time, however, there are shifts in productivity and demand to be taken into account. Over time, suppose earnings will potentially be rising at a rate of η due to productivity increases. This means that at time t,

$$Y_p(\epsilon,t) = (1 + \eta)^t \, Y(\epsilon) \tag{1}$$

where $Y_p(\epsilon,t)$ is the potential income distribution of group ϵ at time t. The actual rate of increase of income may differ from the "potential" rate, because structural changes in the economy may create long term excess demands or excess supply relative to this trend of earnings for the group.

Suppose we had estimates of $S(\epsilon,t)$ and $D(\epsilon,t)$ where

$S(\epsilon,t)$ is the total supply of labor of group ϵ at time t
$D(\epsilon,t)$ is the total demand for labor of group ϵ at time t,

and both estimates of $S(\epsilon,t)$ and $D(\epsilon,t)$ are made under the assumption of the wage trends implied by $Y_p(\epsilon,t)$.

This means that for some groups, there will be positive excess demand and for some others negative excess demand, so that the economywide rate η could not be maintained by group ϵ.

Now for any average full-time earnings rate $Y(\epsilon,t)$, the excess demand function is

$$E[Y(\epsilon,t),t] \equiv D[Y(\epsilon,t),t] - S[Y(\epsilon,t),t] \quad (2)$$

where we write $D(Y,t)$ and $S(Y,t)$ to indicate that for every t, the demand and supply depend upon the wage rate Y, but over time the demand and supply are shifting. Thus the critical question is how the demand and supply shift over time. In equilibrium, the labor market requires

$$D(Y,t) = S(Y,t) \text{ for all } t \quad (3)$$

Our purpose is to estimate the total proportional change in wages between 0 and t--i.e.:

$$\frac{Y(\epsilon,t) - Y(\epsilon,0)}{Y(\epsilon,0)} \quad (4)$$

where $Y(\epsilon,t)$ is the actual wage. This actual wage will have to satisfy the equilibrium condition

$$S[Y(\epsilon,t),t] = D[Y(\epsilon,t),t] \quad (5)$$

Now we make the basic assumption that the supply function $S[Y(\epsilon,t)]$, is not a function of Y(ε,t) but rather is determined by the growth of population, etc. Thus

$$S[Y(\epsilon,t),t] \equiv S(t) \tag{6}$$

Now let us do the following decomposition:

$$\frac{Y(\epsilon,t) - Y(\epsilon,0)}{Y(\epsilon,0)} = \frac{Y(\epsilon,t) - Y_p(\epsilon,t)}{Y_p(\epsilon,t)}\left[\frac{Y_p(\epsilon,t)}{Y(\epsilon,t)}\right] + \frac{Y_p(\epsilon,t) - Y(\epsilon,0)}{Y(\epsilon,0)} \tag{7}$$

We know that

$$\frac{Y_p(\epsilon,t) - Y(\epsilon,0)}{Y(\epsilon,0)} = (1+\eta)^t - 1 \tag{8}$$

since this is the way $Y_p(\epsilon,t)$ is defined. Thus

$$\frac{Y_p(\epsilon,t)}{Y(\epsilon,t)} = (1+\eta)^t \tag{9}$$

Hence our problem is the estimation of

$$\frac{Y(\epsilon,t) - Y_p(\epsilon,t)}{Y_p(\epsilon,t)} \tag{10}$$

To carry out this estimation, we note that for $Y_p(\epsilon,t)$ there will be the following excess demand

$$E[Y_p(\epsilon,t),t] = D[Y_p(\epsilon,t),t] - S(t) \tag{11}$$

But since S(t) must also satisfy

$$S(t) = D[Y(\epsilon,t),t]$$

we have

$$\begin{aligned}\frac{E[Y_p(\epsilon,t),t]}{D[Y_p(\epsilon,t),t]} &= \frac{D[Y_p(\epsilon,t),t] - D[Y(\epsilon,t),t]}{D[Y_p(\epsilon,t),t]} \\ &= 1 - \frac{D[Y(\epsilon,t),t]}{D[Y_p(\epsilon,t),t]}\end{aligned} \tag{12}$$

We further assume that the demand function D is of the constant elasticity type and has the general form

$$D[Y(\epsilon,t),t] = f(t)\bar{D}[Y(\epsilon,t)] = f(t)Y(\epsilon,t)^{\sigma} \tag{13}$$

where $Y(t)$ is the exogenous "shift" function and σ is the elasticity of the demand function. It then follows that

$$\frac{D[Y(\epsilon,t),t]}{D[Y_p(\epsilon,t),t]} = \frac{f(t)\ Y(\epsilon,t)^{\sigma}}{f(t)\ Y_p(\epsilon,t)^{\sigma}} = \left[\frac{Y(\epsilon,t)^{\sigma}}{Y_p(\epsilon,t)}\right] \tag{14}$$

Hence we finally have

$$\frac{E[Y_p(\epsilon,t),t]}{D[Y_p(\epsilon,t),t]} = \left[\frac{Y(\epsilon,t)}{Y_p(\epsilon,t)}\right]^{\sigma} \tag{15}$$

If we assume that $\sigma =,-1$, then we have

$$\frac{E[Y_p(\epsilon,t),t]}{D[Y_p(\epsilon,y),t]} = \frac{Y_p^{-1}(\epsilon,t) - Y(\epsilon,t)^{-1}}{Y_p(\epsilon,t)^{-1}}$$

or

$$\frac{E[Y_p(\epsilon,t),t]}{D[Y\ (\epsilon,t),t]} = \frac{Y_p(\epsilon,t)}{Y(\epsilon,t)}$$

Since $E = D - S$, it follows that

$$\frac{D - S - D}{D} = -\frac{Y_p}{Y}$$

or

$$\frac{S}{D} = \frac{Y_p}{Y}$$

Thus

$$\frac{D}{S} = \frac{Y}{Y_p}$$

Hence

$$\frac{D - S}{S} = \frac{Y}{Y_p} - 1 = \frac{Y - Y_p}{Y_p}$$

Hence finally we have

$$\frac{E[Y_p(\epsilon,t),t]}{S(t)} = \frac{Y(\epsilon,t) - Y_p(\epsilon,t)}{Y_p(\epsilon,t)} \tag{16}$$

The importance of equation 15 is that the expression on the left is the ratio of the *projected* excess demand to the projected total supply, and for each group ϵ, we have data to estimate it. Thus, with the aid of these data, we can estimate the proportional deviation of $Y(\epsilon,t)$ from $Y_p(\epsilon,t)$. Combining equation 16 with equations 7, 8, and 9 gives:

$$\begin{aligned}\frac{Y(\epsilon,t) - Y(\epsilon,0)}{Y(\epsilon,0)} &= (1+\eta)^t - 1 + (1+\eta)^t \frac{E[Y_p(\epsilon,t),t]}{S(t)} \\ &= (1+\eta)^t \left[\frac{E(Y_p,t)}{S} + 1\right] - 1 \\ &= (1+\eta)^t \frac{D(Y_p,t)}{S(t)} - 1 \qquad (17)\end{aligned}$$

Equation 17 provides us with the final estimate for the growth factor of $Y(\epsilon,t)$ over the period 0 to t.

Synthesis with the Discounting Problem

As we noted in the section on the problem of discounting, we have to estimate the present value of the stream of benefits which will accrue in the future. Thus if d is the discount rate and lifetime wage benefits are to be discounted at a rate d, the growth of wages at the rate of η_ϵ can be included in the analysis by changing the discount factor to $d - \eta_\epsilon$, where

$$\eta_\epsilon = (1+\eta)^t \frac{D(Y_p,t)\epsilon}{S(t)\epsilon} - 1.$$

A Comment on Cross-Elasticities

The reader may note that in the discussion above, we have ignored cross-elasticities of demand, i.e., the elasticity of demand for educated workers of group j with respect to change in the wage rate of group k. These elasticities must be recognized as being important since the degree of substitution among the groups is certainly significant. Unfortunately, we can do little to emphasize this importance since no information is available to estimate these elasticities. We may note, however, that had we known these elasticities and the projected fixed supplies of each group, we would have been able to project all the rates of changes of wages simultaneously. To see this, let

$$S_j(t) = D_j[Y_1(t), Y_2(t), \ldots, Y_N(t), t] \qquad (18)$$

where S_j is the fixed supply of educated people of group j

D_j 's the jth demand function

Y_j is the wage of a member of group j

Differentiate with respect to time

$$S_j(t) = \sum_{k=1}^{N} \frac{\partial D_j}{\partial Y_k} \dot{Y}_R \qquad j = 1 \ldots N \qquad (19)$$

Since we assume

$$\dot{S}_j(t) = \pi_j S_j(t)$$

we can write

$$\pi_j S_j(t) = \sum_{k=1}^{N} \frac{\partial D_j}{\partial Y_k} Y_k \left(\frac{\dot{Y}_k}{Y_k}\right) \qquad j = 1 \ldots N$$

and dividing through by $D_j = S_j$ we have

$$\pi_j = \sum_{k=1}^{N} \left(\frac{\partial D_j}{\partial Y_k} \frac{Y_k}{D_j}\right)\left(\frac{\dot{Y}_k}{Y_k}\right) \qquad j = 1 \ldots N$$

But now we note that the elasticities are defined by

$$\sigma_{jk} = \frac{\partial D_j}{\partial Y_k}\left(\frac{Y_k}{D_j}\right)$$

Hence

$$\pi_j = \sum_{k=1}^{N} \sigma_{jk} \frac{\dot{Y}_k}{Y_k} \qquad j = 1 \ldots N \qquad (20)$$

and if we knew π_j and σ_{jk}, we could solve the system of equations above and obtain the projected rates of change in wages $(\dot{Y}_k/Y_k)$ as functions of the elasticities and the growth rates of the supplies.

Calculation of Income Benefits from Title I

In the final report, income benefits will be estimated for both white and nonwhites on the basis of the projected lifetime earnings of fully employed persons in the following categories:

Northern white males
Southern white males
Northern white females
Southern white females

The present values of the lifetime earning will be provided for alternative social time preference rates, for a productivity rate estimated at 2-1/2%, and for appropriate demand/supply ratios derived above for the year 1975. Final estimates will include deduction for direct cost of education and addition for part-time earnings of pupils.

V THE CRIME REDUCTION BENEFITS OF TITLE I PROGRAMS

Introduction

This chapter is concerned with the determinants and costs of juvenile delinquency. In its broadest sense, juvenile delinquency can refer to any nonadult behavior that is objectionable to the adult population. In this sense, delinquency is defined in terms of the expectation of the culture, with adults dominating the expectation. Although this broad view would include many more delinquents than a legal view, it is still true that cultural expectations strongly affect legal definitions. In evaluating benefits of educational programs for disadvantaged youth, account should be taken of all deviant behavior that adversely affects others; investigations using self-report instruments have found that acts of delinquent behavior represent a very small part of total deviancy.[*] [27] However, in order to say something meaningful in quantitative terms, we must restrict the set of facts to be labeled delinquent. For this study, we accept the characterization of juvenile delinquency as "behavior by nonadults which violates specific legal norms or the norms of a particular societal institution with sufficient frequency and/or seriousness so as to provide a firm basis for legal action against the behaving individual or group."[†]

Delinquent behavior is a result of social interaction as well as individual propensities or perversities. There is clearly an intimate connection between individual development, societal conditioning, and delinquent behavior. This interconnection between the individual, society, and a particular act of delinquency is why the determinants of delinquency are numerous and complex. What we seek in this study is a correctly specified regression model which will account for most of the variance in juvenile delinquency. For the model to be useful in policy-making, variables over which the decision-maker has some control should be significant, and account for a sizable part of the total variance.

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[*] Chapter V has a separate bibliography at the end of this chapter.

[†] Reference 44, p. 54.

Preferably, we would like our selection of variables to be determined by a theoretical framework expressing the logical tie between the variables, and pointing out the direction of causation. In general, theories of delinquency are psychological or sociological. There have been no political theories of delinquency, although political factors have been used in other theories; and only recently has the foundation for an economic theory of delinquency been presented.[29]

Psychological Theories

Typical of the psychological approach is the implication contained in the following conclusion: "Our investigation of the origins of criminality reveals that the roots of crime lie deep in early familial experiences--so deep that only the most intensive measures, applied early in life, can offer hope of eradicating them."* This stress on family relationships comes out strongly in psychological analysis of delinquent behavior.[37,58,38,90] However, at least one study has shown that coming from a broken home does not affect the incidence of delinquent behavior.[95]

Most of the psychological explanations of delinquency are based on the idea of ego and superego involvement, brought about primarily through family relationships. Ego damage, self-evaluation, identification, insecurity in interpersonal relations, anxiety caused by inadequacy feelings--all have been used to explain the incidence of delinquency.[23,36,41,42,75,84,91] Acquiring ego identity, for example, is thought to be a prominent part of adolescent growth. If successful, the adolescent goes into young adulthood with ego integrity; if not successful, he is unsure of his ego identity, and suffers ego diffusion. Delinquent behavior is then said to arise from the lack of a realistic identification with society because of ego diffusion. Going through the psychological theories with regard to delinquency, one comes away with a potpourri of causal relationships, and a number of theoretical constructs that are exceedingly difficult to make operational.

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* Reference 57, p. VII

Sociological Theories

Sociologists have developed their theories explaining delinquency from some variation of the theory of "anomie." Anomie has been defined as "a breakdown in the cultural structure, occurring particularly when there is an acute disjunction between the cultural norms and goals and the socially structured capacities of members of the group to act in accord with them....when the cultural and the social structure are malintegrated, the first calling for behavior and attitudes which the second precludes, there is a strain toward the breakdown of the norms, towards normlessness."* [68,73] In this state of normlessness or anomie, the youth, as visualized by the various versions of the theory, rejects socially acceptable norms and replaces them with subcultural norms. Since the norms of the subculture are generally at odds with those of the society, the youth's adherence to subculture norms will usually lead to delinquent behavior.†

A key question for our analyses is, by what process does an individual enter a subculture and adopt its deviant norms? One answer to this question has been presented in the differential association theory of delinquency.[20,97] Simply put, this theory asserts that delinquent behavior is a normally learned response resulting from associations with delinquent as well as nondelinquent norms. Differential association is a cultural transmission view of learning, which depends on the frequency, duration, priority, and intensity of contact with deviant subcultures. Taken by itself, differential association is a rather incomplete theory of delinquency since it fails to explain how the delinquent subculture came into existence in the first place. It does, however, provide a means for understanding delinquent norms within the context of an existing deviant subculture.

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* Reference 61, pp. 162-163

† The three major theoretical versions are given in References 18, 19, and 63, respectively.

Eventually most sociological theories come back to the individual's frustrations arising from the difference between his perceived socially acceptable goals and his perceived ability to achieve these goals.

The aspirations concerning success goals that are not achieved are not very clearly stated, and yet these aspirations are at the center of the anomie concept. Emphasis is usually put on the limited amount of education available to the lower class as a major barrier to achieving success goals through legitimate opportunities.

Bridging the Gap

Recent efforts, combining the psychological and sociological theories of delinquency, have employed interaction models as the tool of analysis. Modifications of the subculture theories of juvenile delinquency seek to take account of such factors as commitments to conformity, effect of situation or circumstance on motives to deviate, acceptance of norms against delinquent behavior, identification of the self with culture/subculture objects and norms, and so on.[9,38,43,44,53,57,83] The important element here is the early socialization presenting particular types of alternative responses that if not checked would lead to deviant behavior. Since early socialization processes differ markedly, individuals in similar situations will not act the same, but will accept or reject deviant response in varying degrees.

In the last ten years, an increasing number of empirical investigations of delinquency have been made using a sociological frame of reference. These empirical investigations have been based either on (1) official statistics from police files, juvenile court records, or probation reports, or on (2) self-report techniques using either an interview or a mailed questionnaire.* An equally large number of empirical findings have been presented using a psychological frame of reference.†

The sociologically based studies have generally been concerned with testing whether deviant subcultures provide the milieu from which delinquent behavior arises, or with trying to determine whether delinquency could be attributed to the existence of anomie. Nearly all of the studies, by sociologists or psychologists, have attempted to provide insights into the etiology, the epidemiology, or the typology of delinquent behavior.

Delinquency and Education

An important body of delinquency research concerns the association of delinquent behavior with education. One causal chain that has been investigated is the chain going from lack of adequate reading ability to general retardation in school, to truancy, to dropping out of school, and finally into acts of delinquency.‡ In a recent study of delinquents referred to the juvenile court in the District of Columbia, it was shown that 52% of the juvenile offenders were in the eighth grade or less, whereas 19% were of an age which would normally have placed them in that grade level. On the other hand, 38% were 16 and 17 years old, which would normally place them in the 11th or 12th grade, but only 2-1/2% of these offenders were in at least that grade at the time of referral.[93] One of the pioneers in delinquency research has recently pointed out, in part as a result of a long term research project in New York City, that "failure in school...has not only a numbing effect on youthful aspirations and on the chances of a career, it is also associated with the formation of habits and attitudes adverse to morale. Retardation leads to truancy and truants become school dropouts."* This educational pattern leading to delinquency cannot be ascribed to inherent intellectual weakness. It has been found that intelligence in delinquents is probably not significantly different from that of the general population.[69,87] There is, of course, a significant difference between delinquents and nondelinquents on a variety of achievement tests; and to the degree that intelligence tests measure achievement and not pure intelligence, their scores are somewhat biased against the delinquent.

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* Representative of the studies using official statistics are References 8, 10, 12, 48, 67, 70, 76, 79, 81, and 100. Representative of the studies using self-report techniques are References 15, 22, 25, 26, 28, 33, 64, 71, and 99.

† Representative of studies using psychological theory are References 23, 36, 37, 42, 46, 56, 57, 58, 69, 75, 84, 88, and 91.

‡ References 11, 46, 49, 50, 51, 52, 56, 60, 62, 78, 92, and 98.

An Empirical Study Relating Delinquency and Education.

What we ultimately want to know are the differences of opportunities, lack of opportunities, status deprivation, reading retardation, etc. that explain the changing volume of delinquency over time and between socioeconomic classes at any given time. Our model is based on the perhaps hackneyed view that delinquency is the product of many interacting factors. Conflicting norms, social deprivation, and economic needs interact to produce the environment within which delinquent behavior is formed.

As a first generalization of the incidence of delinquent behavior, we can use a slight modification of Abrahamsen's "Law". Let D = delinquent acts, SS = degree to which society's norms are accepted (or at least conformed to), and SC = strength of the inner conflict brought about because of the difference between accepted status goals and the individual's perceived ability to achieve those goals, i.e., "anomie". Then we can say that $D \propto \frac{SC}{SS}$, always remembering that this formulation merely helps to present succinctly the conflicting social, economic, and psychological forces causing delinquency. Most of the variables to be used in this study contain elements of both the socializing and "anomic" forces. Thus, a high level of education is a socializing force, although the lack of education is an "anomic" force.

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Reference 52, p. 22.
Reference 27, pp. 460-461.

From the theoretical literature regarding the causes of delinquency, high levels of education, income, and other material claims to status will most strongly influence a person to accept society's norms (SS). On the other hand, unsatisfactory family characteristics, such as missing father, poor housing conditions, unemployment, and being nonwhite (really reflecting discrimination and other barriers) will increase the degree of frustration conflict, or SC. These variables are also interrelated, causing some problems.*

Our purpose is to estimate effects of education on juvenile delinquency. In order to provide quantitative estimates of the relationships specified, relable and valid data must be found. Since there is a serious difference of opinion regarding the reliability and validity of official statistics of delinquency, and since official statistics are used in the empirical work presented here, our justification for using official data is given in some detail in Appendix B.

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* It will be seen later, when the results of our regression analysis are presented, that the bivariate correlation between several of the independent variables is very high. In statistical terminology, this results in a problem of multicolinearity. This problem does not seriously affect any predictions we would want to make from the estimated regression equation, but it does make for difficulty in stating the specific quantitative significance of the several highly interrelated variables. Although we could use factor analysis to extract empirically independent factors made up of clusters of highly correlated variables, we prefer to use multivariable regression analysis to determine the significance and relative importance of the several variables chosen.

The model to be used to make this estimate employs census data and will include the following variables:*

Education (X_1), percent of persons 25 and over who have completed four years of high school or more; (X_2), percent of males age 16 or 17 who are enrolled in school. This variable is available only on a citywide basis and will be used only for the regressions on intercity differences in delinquency.

Income (X_3), median family income.

Property ownership (X_4), percent of all housing units that are owner-occupied.

Family characteristics (X_5), percent of females age 14 and over who are separated or divorced.

Housing conditions (X_6), percent of occupied housing units with 1.01 or more people per room.

Employment opportunities (X_7), percent of male civilian labor force that is unemployed.

Racial factor (X_8), percent of the population that is nonwhite;
($X_{8'}$) alternatively (with changed sign) the percent white.

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* All of the delinquency data used in the set of regression results reported in this chapter are for 1950 or 1960; similarly, all of the independent variables, unless otherwise stated, have been taken from the 1950 and 1960 U.S. Census of Population and Housing.

Other independent variables that will also be used are:

(X_9), court appearances of males age 17 to 20 per 1,000 males age 17 to 20 in the relevant population. This variable will be used only for the Boston regressions, and can be looked at as a proxy for the existence of deviant subcultural conditions.

(X_{10}), percent of persons over 5 years of age who lived outside this standard metropolitan statistical area (SMSA) or county in 1955. This is a mobility factor, and to the extent that the migrants are those who are at a relative disadvantage in the area from which they migrated, it is assumed that they are apt to experience anomie, so that (X_{10}) will have a positive sign. This may be true of southern negroes. Northern white migrants tend often to be the most able, moving in response to improved opportunities, in which case this sign will be negative.

(X_{11}), regional dummy variable: 0 = south, 1 = north. This is used for the one set of intercity comparisons, to pick up any peculiar regional differences in the delinquency data. (X_9 and X_{11} are the only variables that have not been taken from the 1950 or 1960 Census of Population and Housing.)

The variables X_1, X_2, X_3, X_4, and X_8, should have negative signs since increases in their values are expected to cause decreases in delinquency.

On the other hand, the variables X_5, X_6, X_7, X_8, and X_9 should have positive signs, since increases in their values are expected to be related to increases in delinquency.

Our dependent variables are:

$\underline{Y_{us}}$, arrests for property crimes (burglary, larceny, robbery, and auto theft) of males under 18 in 97 cities of the United States during 1960 per 1,000 males under 18 in those cities. These data have been acquired through unpublished FBI work sheets from which the aggregates used in the Uniform Crime Reports are derived. (All the cities used have a population greater than 25,000.)

Y_B, court appearances of males age 7-16 in Boston census tracts per 1,000 males age 7-16 in corresponding tracts for 1960. Only census tracts with more than 50 males age 7-16 were used. The number of tracts used was 144. The data were compiled from "The Boston Youth Opportunities Project: A Report and a Proposal," Action for Boston Community Development Incorporated, December 1963.

Y_{dc50}, number of referrals of males age 10-17 to the juvenile court of Washington, D.C. by D.C. census tracts during 1950 per 1,000 males age 10-17 in the corresponding tract. Tracts with less than 100 males were omitted, leaving 92 tracts. The delinquency data were taken from an SRI Report by I. Wallach, "A Description of Active Juvenile Offenders and Convicted Adult Felons in the District of Columbia," Vol. 1: Juvenile Offenders, July 1966.

Y_{dc60}, same as Y_{dc50} but for 1960. There were 106 tracts that had more than 100 males age 10-17, from the same source as Y_{dc50}.

Y_{sf}, male delinquents (official and unofficial juvenile court cases) age 10-19 in San Francisco, California by census tracts per 1,000 males 10-19 in corresponding tracts for 1960. Ninety-four census tracts with more than 100 males age 10-19 were analyzed. Data were taken from the report on "Juvenile Delinquents in San Francisco, 1960" prepared by the subcommittee on Research and Statistics of the United Community Fund of San Francisco, March 1964.

Y_o, male delinquents age 10-17 in Oakland, California by census tracts per 1,000 males age 10-17 in corresponding tracts for 1960. The juvenile delinquency data used were obtained from official records of the Juvenile Division of the Oakland Police Department for 1960.*

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* An information sheet, later punched on IBM cards, is made out for every juvenile taken into custody by the Oakland police. Among other items, these cards list the juvenile's age, sex, race, crime, disposition by the police, and census tract of residence. The present set of regressions is based on 5,633 police apprehensions of males age 10-17 who resided in Oakland during 1960. There are 72 census tracts in Oakland. Regressions were run, excluding five tracts having less than 50 males age 10-17.

Since the Oakland data were broken down by type of crime and police disposition, a more intensive analysis was made using these data. The 5,633 police apprehensions were broken down into two levels of seriousness and three classes of dispositions. Level I crimes (most serious) included rape, robbery, aggravated assault, burglary, theft, auto theft, and other assaults; Level II crimes were primarily of the minor type--runaway, incorrigibility, loitering, drinking by a minor, and disorderly conduct. The dispositions were : (A) interview only, or reprimand and release, (B) cited for a specific offense, or given a notice to appear at a juvenile court; and (C) arrested. Seven sets of regressions were run on various combinations of offenses and dispositions.

1. $Y_{I+II\ (A,B,C)}$ = 1960 Oakland Crime rates for males 10-17 by census tract, for crimes I and II, and dispositions A, B, and C.
2. $Y_{I+II\ (B,C)}$
3. $Y_{I+II\ (C)}$
4. $Y_{I+II\ (A)}$
5. $Y_{I+II\ (A,B)}$
6. $Y_{I\ (A,B,C)}$
7. $Y_{I\ (B,C)}$

The means of the above variables and of the X_1 to X_{11} variables are presented in Table 43.

The regression results are presented in Tables 44 through 55. The probability level at which statistical significance is established is usually given at the 0.05 of 0.01% level. However, where a priori considerations suggest the proper sign of the regression coefficient, a slightly lower level of significance, say 0.10, may be sufficient.*

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* Reference 30, footnote 8, p.126

Table 43

MEANS OF THE VARIABLES USED IN THE REGRESSION ANALYSIS

Independent Variable	97 Cities	Boston	D.C. 1950	D.C. 1960	San Francisco	Oakland
$\bar{X}_1$	0.440	0.392	0.465	0.452	0.493	0.464
$\bar{X}_2$	0.808	n.u.	n.u.	n.u.	n.u.	n.u.
$\bar{X}_3$	n.u.	n.u.	\$3,202	\$6,328	\$6,788	\$6,509
$\bar{X}_4$	n.u.	n.u.	n.u.	n.u.	n.u.	0.474
$\bar{X}_5$	n.u.	0.03	0.176	0.138	0.131	0.053
$\bar{X}_6$	0.094	0.092	0.105	0.143	0.072	0.082
$\bar{X}_7$	0.051	0.065	0.074	0.029	0.039	0.081
$\bar{X}_8$	0.872	0.886	0.647	0.442	0.794	0.759
$\bar{X}_9$	n.u.	268.6	n.u.	n.u.	n.u.	n.u.
$\bar{X}_{10}$	0.156	0.052	0.071	0.142	0.115	0.111
$\bar{X}_{11}$	0.2	n.u.	n.u.	n.u.	n.u.	n.u.
$\bar{Y}$	13.2	36.5	174.8	288.5	114.3	
$\bar{Y}_{I+II(A,B,C,)}$						263.5
$\bar{Y}_{I+II(B,C)}$						145.9
$\bar{Y}_{I+II(C)}$						82.7
$\bar{Y}_{I+II(A)}$						117.6
$\bar{Y}_{I+II(A,B)}$						180.8
$Y_{I(A,B,C)}$						97.9
$Y_{I(B,C)}$						76.7

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n.u. = not used in this particular regression.

Note: The actual data for the independent variable were put into the computer in whole numbers; no decimal points were used. To determine what the regression coefficient would be if the values had been put in as decimal fractions, move the decimal point of the computed coefficient three places to the right for the coefficient of X_1, X_2, X_4, X_8, and X_{10}, and two places to the right for the coefficients of X_5, X_6, and X_7. For example (using the Oakland Results shown in Table 53), the coefficient for X_1 using $Y_{I+II(A,B,C)}$ is -0.28. The mean of X_1 as a proportion of the population was 0.464. The value placed in the computer was 464; therefore the regression coefficient if 0.464 had been used would be -280. This, of course, does not affect the elasticities obtained in the Oakland studies.

c2

TABLE 44

REGRESSION RESULTS FOR 97 U. S. CITIES WITH POPULATION GREATER THAN 25,000 FOR 1960

Variable	Coefficient	T-Ratio
X_1	0.002	1.2
X_2	-0.0004	-0.3
X_6	0.006	2.0
X_7	0.01	1.7
X_8	0.004	4.2
X_{11}	-1.0	-3.0
X_{10}	0.0005	0.3

$\bar{R}^2$* $= 0.24$

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* $\bar{R}^2$ = corrected $R^2 = 1 - \left[\left(\frac{N-1}{N-k}\right)\right] (1-R^2)$ where N = the number of observations and k = the number of independent variables.

c.2

Table 45

REGRESSION RESULTS FOR BOSTON 1960

Regression No.	Variable	Coefficient	T-Ratio
#1	X_1	-0.06	-2.8
	X_6	-0.02	-0.3
	X_8,	-0.02	-2.1
	X_9	0.07	3.9
	X_{10}	-0.08	-3.3
	$\bar{R}^2 = 0.42$		
#2	X_1	-0.037	-1.51
	X_5	0.53	2.61
	X_6	-0.014	-0.20
	X_7	0.037	0.41
	X_8,	-0.011	-0.94
	X_9	0.061	3.52
	X_{10}	-0.026	-0.94
	$\bar{R}^2 = 0.44$		

cz

TABLE 46

BIVARIATE CORRELATION OF X_1 WITH THE BOSTON VARIABLES USED 1

$rX_1, X_5 = -0.32$

$rX_1, X_6 = -0.66$

$rX_1, X_7 = -0.70$

$rX_1, X_8' = 0.26$

$rX_1, X_9 = -0.54$

$rX_1, X_{10} = -0.10$

TABLE 47

REGRESSION RESULTS FOR WASHINGTON,D.C., 1950

Variable	Coefficient	T-Ratio
X_1	-0.43	-3.3
X_3	0.0008	0.04
X_5	1.39	2.8
X_6	-0.06	-0.4
X_7	0.09	0.4
X_8'	-0.16	-2.0
X_{10}	0.40	0.7

$\bar{R}^2 = 0.52$

---

* X_5 = percent widowed and divorced for the D. C. 1950 regression.

Table 48

BIVARIATE CORRELATIONS OF X_1 WITH THE OTHER INDEPENDENT VARIABLES USED IN THE WASHINGTON, D. C. 1950 REGRESSIONS

$rX_1, X_3 = 0.75$

$rX_1, X_5 = 0.13$

$rX_1, X_6 = -0.46$

$rX_1, X_7 = -0.29$

$rX_1, X_8' = 0.73$

$rX_1, X_{10} = 0.44$

Table 49

REGRESSION RESULTS FOR WASHINGTON, D.C. 1960

Regression No.	Variable	Coefficient	T-Ratio
#1	X_1	-0.50	-2.8
	X_5*	3.23	5.4
	X_6	0.16	0.5
	X_8'	-0.04	-0.5
	X_{10}	0.40	2.3
	$\bar{R}^2 = 0.46$		
#2	X_1	-0.12	-0.6
	X_3	-0.04	-3.0
	X_5	2.76	4.7
	X_6	-0.13	-0.4
	X_7	1.48	2.0
	X_8'	0.01	0.2
	X_{10}	0.14	0.8
	$\bar{R}^2 = 0.52$		

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* Includes percent separated, divorced and widowed.

Table 50

BIVARIATE CORRELATIONS OF X_1 WITH THE OTHER INDEPENDENT VARIABLES USED IN THE WASHINGTON, D. C. 1960 REGRESSION

$rX_1 , X_3 = 0.85$

$rX_1 , X_5 = -0.31$

$rX_1 , X_6 = 0.80$

$rX_1 , X_7 = -0.30$

$rX_1 , X_{8'} = 0.76$

$rX_1 , X^{10} = 0.30$

TABLE 51

REGRESSION RESULTS FOR SAN FRANCISCO, CALIFORNIA, 1960

Regression No.	Variable	Coefficient	T-Ratio
#1	X_1	-0.22	-3.4
	X_3	0.006	-1.4
	X_5	0.80	5.5
	X_6	0.10	0.7
	$X^{8'}$	0.03	1.1
	X_{10}	0.11	1.4
	$\bar{R}^2 = 0.51$		
#2	X_1	-0.06	-0.7
	X_3	-0.005	-1.5
	X_5	0.56	3.7
	X_6	0.21	1.5
	X_7	1.35	3.6
	$X_{8'}$	0.08	2.8
	X_{10}	0.002	0.03
	$\bar{R}^2 = 0.57$		

TABLE 52

BIVARIATE CORRELATION BETWEEN X_1 AND OTHER INDEPENDENT VARIABLES USED IN SAN FRANCISCO 1960 REGRESSIONS

$rX_1 , X_3 = 0.71$

$rX_1 , X_5 = 0.21$

$rX_1 , X_6 = -0.70$

$rX_1 , X_7 = -0.68$

$rX_1 , X_8 = 0.34$

$rX_1 , X_{10} = 0.31$

Table 53

REGRESSION RESULTS FOR OAKLAND, CALIFORNIA
1960

Dependent Variable	Independent Variable	Coefficient	t-Ratio	Elasticity	$\bar{R}^2$
$Y_{I+II(A,B,C)}$	X_1	-0.28	-2.8	-0.49	
	X_4	-0.006	-0.1	-0.01	
	X_5	27.9	2.7	0.56	0.74
	X_8'	-0.17	-2.4	-0.49	
	X_{10}	0.33	0.9	0.14	
$Y_{I+II(B,C)}$	X_1	-0.14	-1.9	-0.45	
	X_4	0.002	0.03	0.01	
	X_5	18.5	2.6	0.67	0.69
	X_8'	-0.13	-2.5	-0.68	
	X_{10}	0.30	1.1	0.23	
$Y_{I+II(C)}$	X_1	-0.10	-2.1	-0.56	
	X_4	-0.01	-0.2	-0.04	
	X_5	10.2	2.1	0.65	0.65
	X_8'	-0.07	-2.1	-0.64	
	X_{10}	0.25	1.4	0.34	
$Y_{I+II(A)}$	X_1	-0.14	-3.4	-0.57	
	X_4	-0.01	-0.2	-0.03	
	X_5	9.42	2.2	0.42	0.70
	X_8'	-0.04	-1.5	-0.28	
	X_{10}	0.03	0.2	0.02	
$Y_{I+II(A,B)}$	X_1	-0.18	-2.9	-0.46	
	X_4	0.001	0.02	0.003	
	X_5	17.7	3.0	0.52	0.76
	X_8'	-0.10	-2.4	-0.42	
	X_{10}	0.08	0.4	0.05	
$Y_{I(A,B,C)}$	X_1	-0.11	-2.0	-0.52	
	X_4	-0.01	-0.1	-0.03	
	X_5	10.9	1.9	0.59	0.67
	X_8'	-0.11	-2.9	-0.85	
	X_{10}	0.15	0.7	0.17	
$Y_{I(B,C)}$	X_1	-0.09	-1.7	-0.54	
	X_4	0.01	0.1	0.04	
	X_5	10.9	2.1	0.75	0.64
	X_8'	-0.09	-2.5	-0.89	
	X_{10}	0.18	1.0	0.26	

TABLE 54

REGRESSION RESULTS FOR OAKLAND, CALIFORNIA, 1960

(Regressed Against Seven Variations of the Independent Variable)

Dependent Variable	Independent Variable*	Coefficient	T-Ratio	Elasticity	$\bar{R}^2$
Y_I + II (A.B.C)	X_1	-0.74	-9.0	-1.30	0.55
Y_I + II (B,C)	X^1	-0.45	-7.8	-1.43	0.48
Y_I + II (C)	X^1	-0.28	-7.7	-1.57	0.48
Y_I + II (A)	X^1	-0.29	-9.5	-1.14	0.58
Y_I + II (A,B)	X^1	-0.45	-9.3	-1.15	0.57
Y_I (A.B.C.)	X^1	-0.35	-8.0	-1.66	0.49
Y_I (B.C.)	X^1	-0.28	-7.3	-1.69	0.45

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* The percent of the population over 25 with four years of high school or more.

Table 55

BIVARIATE CORRELATION MATRIX FOR ALL VARIABLES USED IN THE OAKLAND REGRESSION ANALYSIS FOR 1960

	X_1	X_3	X_4	X_5	X_6	X_7	X_8'	X_{10}
X_1	1.00	0.94	0.61	-0.67	-0.77	-0.79	0.69	0.08
X_3	0.94	1.00	0.77	-0.78	-0.69	-0.81	0.68	-0.02
X_4	0.61	0.77	1.00	-0.81	-0.38	-0.67	0.44	-0.37
X_5	-0.67	-0.78	-0.81	1.00	0.56	0.85	-0.73	0.13
X_6	-0.77	-0.69	-0.38	0.56	1.00	0.75	-0.80	<0.01
X_7	-0.79	-0.81	-0.67	0.85	0.75	1.00	-0.76	0.02
X_8'	0.69	0.68	0.44	-0.73	-0.80	-0.76	1.00	0.13
X_{10}	0.08	-0.02	-0.37	0.13	<0.01	0.02	0.13	1.00

Table 56

VALUE OF t-RATIO

(Value of T-Ratio Necessary for Given Level of Significance, Using Two-Tailed and One-Tailed Test of Significance; Over 50 Degrees of Freedom in All Cases)

Level of Significance	Two-Tailed Test	One-Tailed Test
0.20	1.31	0.85
0.10	1.70	1.31
0.05	2.04	1.70
0.02	2.45	2.10
0.01	2.75	2.45

In fact, since we do have a priori considerations suggesting the "correct" sign of the coefficients, a one-tailed test of significance should be adequate. Using a one-tailed test, we know that if alpha is the level of significance determined by the given t- ratio for the two-tailed test, then the appropriate level of significance for a one-tailed test using the same t- ratio is alpha divided by two. As Table 56 shows, when a one-tailed test is used, the necessary t- ratios for significance at the 10, 5, 2, and 1 percent levels, with more than 50 degrees of freedom, would be 1.3, 1.7, 2, and 2.45. Moreover, if we were to accept the 20% level as being appropriate, a t- ratio of 0.85 would be significant for a one-tailed test. To determine the relative size of the effects of the independent variables on the dependent variables, the elasticities calculated at the mean values of the variables are of considerable use. The elasticities will tell us the percentage change in the dependent variables which occurs with a 1% change in the independent variable for which the elasticity is computed. Elasticities will be presented only for the Oakland results, which are the most detailed and reliable data used in the regression analysis in this chapter. Elasticities for the other data, which are far less reliable indicators of the incidence of delinquency, are of the same order of magnitude as the Oakland elasticities for similar variables.

Results for the 97 cities shown in Table 44 are not very useful. The explained variance is very small and the coefficient for X_1 has the "wrong" sign. It seems that a comparison of FBI delinquency data between cities of the United States is not likely to be very revealing. Intercity differences in most of the relevant variables do not have enough variance to provide us with good measurements of the suggested relationships. The amount of intercity variation in delinquency that can be explained by the set of variables chosen appears to be minimal.

When Boston data by census tracts are used, the independent variables account for 42-44% of the variance in delinquency. The sign of X_{10} is indicative of the high economic status of migrants to this area. The coefficient of X_6 is not significant. The positive sign for X_{10} is significant at the 0.01% level in regression No. 1 and at the 0.2% level for a one-tailed test in regression No. 2.

X_1 taken by itself accounts for 19% of the variance in the dependent variable. The coefficient of X_1 when taken alone is -0.1, and the t-ratio is -5.7. Table 46 shows the bivariate correlation of X_1 with the other independent variables used: ($r_{X}i$, ${}_{X}j$ = bivariate correlation of X_i with X_j).

For the 1950 Washington, D.C. results, only variables X_1, X_5, and X_8, are significant; and they all have the right signs. Taken alone, X_1 in this regression accounts for 40% of the variance in the dependent variable. The coefficient of X_1 alone is -0.56 and the t- ratio is -7.8. Table 48 shows the bivariate correlation of X_1 with the other independent variables.

Using the five variables shown in regression No. 1 for the D.C., 1960 results in Table 49 gives the correct sign for all of the coefficients. Adding variables X_3 and X_7 to the regression produces coefficient for X_6 and X_8, with the wrong sign, but neither of the latter variables has significant coefficients. However, when X_3 and X_7 are included, the coefficient for X_1 is significant only at the .3% level for a one-tailed test. Moreover, the bivariate correlation of X_1 and X_3 is 0.85. Taken alone, X_1 accounts for 32% of the variance in the dependent variable, with a coefficient of -0.75 and a t- ratio of -7.0.

For the San Francisco results shown in Table 51, the sign of X_8 is wrong. Moreover, the coefficient is highly significant as a two-tailed test when all seven variables are used, and is significant at the 0.15% level on a one-tailed test when only six variables are used. The only explanation for the sign of X_8, which would fit our conceptual framework, is that in San Francisco the racial factor operates perversely in that being white is more likely to lead to delinquent acts; this is not very plausible. The more likely reason for the sign is that the variables in the regression have nonlinear relationships with delinquency and/or suffer from severe multicolinearity which makes it difficult to interpret the individual coefficients. Including X_7 into the regression for San Francisco makes the coefficient of X_1 nonsignificant, but increases the level of significance of X_6 and X_8. Taken alone, X_1 explains 28% of the variance in delinquency, and the value of the coefficient is -0.23, with a t-ratio of 6.0.

Our most detailed analysis was done on the juvenile delinquency data from Oakland, California. As shown in Table 53, seven variations in the dependent variable were used in the regression. These variations provide insight into delinquency and its determinants according to the seriousness of offense and disposition by police after contact. Moreover, for the Oakland regression results, we have computed elasticities giving the relative influence of each of the independent variables on each of the dependent variables. In each of the seven sets of regressions for Oakland, results are given for only the first five variables used in an eight variable step-up option, where an additional variable is added on each run. The remaining three variables, X_3, X_6, and X_7, added very little to the explained variance (R^{-2}); when they were included, the sign of the coefficient for X_1 changed and was no longer significant. Since it is the educational variable that is of most interest to us, and since the bivariate correlations between X_1 and the three omitted variables (X_3, X_6, and X_7) are very high (see Table 55), we decided that results should be presented using only the first five variables in the regression.

The five variables chosen explained from 64% to 76% of the variation in the Oakland census tract. From the R^{-2},s alone, we find that the more serious the offense, and the farther along in the adjudication process the juvenile is sent, as shown by the police disposition, the lower the explanatory power of the related groups of independent variables. $Y_{I(B,C)}$, which refers to the crime rate for the most serious offense, with the two sternest police dispositions, has the lowest $\bar{R}^2$, 0.64. All of these regressions show that the variables used explain almost 2/3 to 3/4 of official juvenile delinquency. What is more important, as Table 54 shows, is that X_1 alone explains 45% to 58% of the delinquent behavior recorded in Oakland in 1960. Here again, the independent variable used has somewhat less explanatory power for delinquency of the more serious kind.

The bivariate correlation matrix presented in Table 55 gives some indication of the extent of intercorrelation among some of the variables. Intercorrelation is especially prominent between X_1 and X_3, X_1 and X_6, X_1 and X_7, X_3 and X_4, X_3 and X_5, X_3 and X_7, X_4 and X_5, X_5 and X_7, X_6 and X_7, X_6 and $X_{8'}$, and X_7 and $X_{8'}$. Ten of these 11 highly intercorrelated pairs include the three variables that have been excluded from the results shown in Table 53 (i.e., X_3, X_6 and X_7).

From the derived elasticities shown in Table 53, the effect on delinquency of a given percentage change in the relevant variable can be calculated. Using the all offense and all disposition class, $Y_{I+II\ (A,B,C)}$, we can see that a 10% increase in the percentage of those over 25 who have graduated from high school should produce a 4.9% reduction in the crime rate. Since the mean of X_1 was 0.464, this indicates that increasing X_1 to 0.51 would reduce the crime rate for all offenses and disposition from 263.5 per thousand males aged 10-17 to 250.6 per thousand males of that age.

Although, as was shown above, the $\bar{R}^2$ is lowest for the more serious crimes and dispositions, the elasticity for the educational variable used is somewhat higher for that class of delinquency than for the other two classes. If we take $Y_{I(B,C)}$, then a 10% increase in X_1 will reduce the crime rate, for $Y_{I(D,C)}$, from 76.7 per thousand males 10-17 to 72.6 per thousand males aged 10-17. The actual value of the benefits attributable to the increased percentage of high school graduates will, of course, depend on the costs attributable to delinquency.

Cost of Delinquency[*]

It is the cost of delinquency, and not crime in general, that is to be estimated; this will require some drastic assumptions to obtain meaningful estimates of delinquency isolated from other aspects of crime. However, since the probability statements that can be made with the coefficients of our regression results are relevant only for juvenile delinquents, it is essential that we try to get reasonable estimates of delinquency costs in order to derive meaningful figures for benefits attributable to a reduction in the probability of delinquency through Title I programs.

Crime imposes a burden on society in three ways:

1. In a society that places utility on freedom of movement, freedom from fear of attack, and freedom from corrupting influence for oneself and one's family, the existence and extent of delinquency impose a psychic cost.
2. The more objectively determinable costs associated with prevention, detection, adjudication, and treatment of delinquency and of delinquents
3. Direct and indirect costs of delinquency such as loss of income, medical costs, private security arrangements, etc.

The subjective judgment involved makes it difficult to determine cost 1. This difficulty is perhaps more pronounced for the economist. Psycho-sociological research has developed scales designed to show the magnitude of social aversion to various categories of delinquent behavior. Perhaps the most useful one is the Sellin-Wolfgang scale developed in their book, "The Measurement of Delinquency."[80] The Sellin-Wolfgang scale is essentially a ranking scale (1 to 26) for types of delinquent acts ranging from 1, stealing property valued under $10, to 26, engaging in a criminal act leading to the death of the victim of that act. To transform this scaling index into a monetary value usable in a cost calculation may be a difficult undertaking. However, even a rough approximation using the Sellin-Wolfgang scale could prove useful.

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[*] This is the least developed section of Chapter V. More precisely, at present, this section is primarily a conceptual statement of what we hope to accomplish in the future.

In 1965, 555,000 juvenile delinquency cases concerning males (excluding traffic offenses) were handled by juvenile courts in the United States. Of that total, approximately 33% were for major crimes, 46% were for minor crimes, and the remaining 21% were for delinquent tendencies (running away, truancy, etc.). Total arrest figures would show a higher proportion of delinquent tendencies because most of those arrested and released without court disposition will be in this category.[21,45] The problem is to determine how a social cost is to be imputed to the class of arrests for delinquent tendencies that are "so seriously anti-social as to interfere with the rights of others or to menace the welfare of the delinquent himself, or of the community." Private costs in this case do not present any serious problems. Similarly, most of the direct social costs can probably be reliably approximated. However, the indirect social costs, that nebulous area where value judgments become important, may present a difficult if not insuperable obstacle to reliable quantification. But despite all the possible difficulty in ascribing indirect social costs to some of the acts considered as delinquent behavior, an attempt must be made to determine these costs. Finally, malicious mischief which does not result in property loss or visible physical damage has a strong adverse effect on both the object of the mischief and the neighborhood in which it takes place. Although this is a problem for the entire gamut of crime, it is especially serious in the area of delinquent behavior; and this is precisely because, as we noted at the beginning of this chapter, definitions of juvenile delinquency are heavily influenced by cultural expectations.

Cost 2; i.e., direct costs associated with prevention, etc., will receive the major emphasis because of their accessibility as well as their utility, given that most burdens can be valued in monetary terms. Even here, however, there will undoubtedly be serious problems of measurement and data acquisition. For example, how does one prorate the amount that business and individuals spend on insurance, in order to obtain the share made necessary by delinquency? Or, how does one allocate various public costs for countermeasures against the delinquent and against adult offenders? Finally, we need incremental costs. That is, for our purposes it is not enough to determine the average per capita cost for, say, some juvenile detention home, but rather we are concerned with the additional costs brought about by the admittance of one more delinquent into the detention home. The same principle applies to all the elements of costs, and from a practical data collection viewpoint, this need compounds our problem enormously. In principle, what we need is a correctly specified cost function that we can differentiate with respect to the several types of delinquent behavior.

The following summary outline presents what is regarded as the relevant and important coststo be estimated. Whether estimates of some of the elements are feasible is not considered at the moment. Costs are divided into direct and indirect:

A. Direct Costs

  1. Public

    a. Police costs--prevention, detection, and apprehension (includes capital and labor costs).
    b. Adjudication--includes probation investigation, public costs of the trial, and pre-sentencing investigation (includes capital and labor costs).
    c. Commitment costs--include medical needs, institutional rehabilitation procedures, etc.
    d. Post-commitment rehabilitation costs--mainly probationary needs.
    e. Damage or loss of property from delinquent acts.
    f. Payments to delinquent or victim or respective families (for example, ADC).

  2. Private

    a. Loss or damage of property of victim.

    - b. Medical costs resulting from physical damage to victim.
    - c. Defense costs to delinquent during adjudication proceedings.
    - d. Insurance payments by individuals or businesses against delinquent activity.
    - e. Private security arrangements by business or individual (for example, bodyguards).

B. Indirect Costs

  1. With regard to delinquent

    - a. Income loss while incarcerated less value of work in institution (for example, forestry camps).
    - b. Income change due to "ex-con" status less increased productivity due to educational investment provided to institutionalized delinquent (the former is negative while the latter should be positive).
    - c. Income loss due to delinquent's absence from the labor force (adjusted for probability of employment if in the labor force).
    - d. Income loss if killed.

  2. With regard to victim

    - a. Income loss due to loss of work--including lifetime expected earnings if killed.
    - b. Psychic costs--especially with respect to acts of violence (Sellin-Wolfgang index).

A serious problem related to determination of costs is the evaluation of transfer payments--when A takes item X or amount $Y from B, this transfers that item or amount from B to A's individual account. The total production of the nation may not be reduced at all by these transfers. Yet delinquency is somewhat unique because it is generally agreed that social welfare is clearly reduced when A steals $Y from B. This means either that summing individual effects into a social aggregate is not a correct procedure in a study of the cost of delinquency or that a method for weighting losses to victims and rewards to delinquents must be made to reflect society's values with regard to delinquency. It should be a basic assumption of our study on the cost of delinquency that the transfer of dollar values by illegal means should not be netted out to zero. It may prove impossible to obtain reliable and accurate estimates of these costs, but conceptually it is important to recognize them as costs and not allow them to be washed out in the aggregation process.

This is an important point. We must estimate the cost of delinquency to the nondelinquent and to the delinquent sectors separately. The former would mainly consist of direct victims of delinquency and the rest of the nondelinquent population; the latter would refer to the delinquent and his family. In a sense, we should take account of the external diseconomies from delinquent activity. If in deriving an aggregate social cost function, we completely neglected effects such as transfers, we might find that delinquency, like pyramids, can be quite "productive," especially in times and in places where unemployment is high. In this respect, delinquency has some of the unique characteristics of other "make work" type undertakings.

Determination of psychic costs represents another major obstacle in the assessment of the costs of delinquency. In part, psychic costs are reflected in the costs of relocation to a less delinquency prone district, or the difference in income from changing jobs due to the fear of delinquent behavior in the present area of work. However, the largest part of the psychic costs would not be included in figures for relocation or job change. For example, how do we place a monetary value on the cost to a rape victim? Generally, the costs are mentioned in a conceptualization of the problem and left aside as unmeasurable, in the empirical section.

However, there is a way to get what might be a good approximation of these costs. The method proposed involves the index developed by Sellin and Wolfgang. The index is designed to rank the subjective response of the people toward various criminal activities. It is a kind of revealed choice, since the index measures the degree of harm attributable to crime as revealed by a sample of individuals in the community. Details of construction and testing of the index representing magnitude of harm attributable to various crimes can be found in the Sellin and Wolfgang test and also more succinctly in an article by S. S. Stevens.*

In general, Sellin and Wolfgang found that the relation between the category of offense (for example, stealing a car, robbing an individual of $5 and wounding him in the process, etc.) and the magnitude of the harm associated with the offense is linear in the logarithm of the magnitude estimation. Moreover, it was found that the relationships were generally invariant with respect to the class of raters (38 juvenile court judges, 286 police officers, and 245 students from two universities, all in the Philadelphia area). The magnitude of the harm assigned to results of criminal acts is given in weights ranging from 1 to 26. For example, the act of stealing less than $10 is given a weight of 1, a homicide has a weight of 26, while a robbery from an individual in which the victim is killed and less than $10 is taken from him is given a total weight of 27 (1 for the money and 26 for the killing). This also illustrates a useful property of the rating system by Sellin and Wolfgang, that is, it is additive. (Since the magnitude is linear in the logarithm of the magnitude estimation, there are problems associated with how to make the logarithms additive.) As another example, take forcible rape, which is given a total weight of 11--8 for the sex act itself, 2 for intimidation of a victim, and 1 for infliction of a minor injury. If a more serious injury resulted, the total score would be correspondingly higher.

Another interesting result that Sellin and Wolfgang found was an empirical verification of the diminishing marginal utility of money. They found that the magnitude of damage could be estimated as a power function of the amount of money stolen, with the exponent being approximately 0.2. A number of other pertinent comments could be made with regard to the Sellin-Wolfgang index and its utility in estimating the psychic costs. Overall, the authors' conclusion seems reasonable: "a pervasive social agreement about what is serious and what is not appears to emerge, and this agreement transcends simple qualitative concordance; it extends to the estimated degree of the seriousness of these offenses."

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* Reference 96, especially pp. 536-538.

Operationally, the way in which psychic costs could be estimated through the use of the Sellin-Wolfgang index would be as follows. A monetary value is derived for several crime categories say 1, 8, 15 and 26; a line of some kind is drawn between these points; monetary values of any crime with an index value between 1 and 26 is then read off the curve. For example, 26 represents an individual killed during the commission of a crime. Some estimate of the economic loss incurred through lost production can then be used as an estimate for 26. It may be difficult to obtain agreed-upon dollar estimates for enough categories of delinquent acts, but the problem should not be much more difficult than deriving the other indirect costs of delinquency. However, the payoff in terms of a more realistic assessment of the costs of delinquency justifies the effort to get a dollar estimate of psychic costs.

In order to give some figures on the cost of delinquency, a very rough and partial approximation to that cost for the State of California will be presented. These figures are not intended to be representative of anything other than the specific factor to which they are ascribed.

A study by the California Department of the Youth Authority of 1,432 parolees aged 16-1/2 through 24, of which 1,020 were reported to be in the available labor force, found that only 45% had full-time employment, while 37% were unemployed.[82] Moreover, the unemployment rate for Negroes was over 51%, with only 28% of the Negro sample employed full-time. For the United States during that same period, the unemployment rate for all youths aged 14-24 was 16%. Since the overall California rate of unemployment was approximately equal to that for the entire country, it seems reasonable to assume that the California rate for 14-24 year olds is also approximately equal to that for the entire country. If the California parolees, therefore, had the same unemployment rate as all Californians for the given age, an additional 214 parolees would be employed. With an average annual wage of, say, $4,000 for that age group, the gross addition to California income would be $856,000.

Another revealing finding from the study mentioned above[82] was that parolees who had received vocational training while they were institutionalized had only a slightly better chance of finding full-time jobs over those without vocational training. Moreover, of those parolees who received vocational training, only 13% obtained closely related jobs, 14% obtained moderately related jobs, and 52% obtained completely unrelated jobs; and about 19% had held no job since their release. (These percentages are from reference 82, no relevant information being available for the other 2%.) For a sub-sample of 849 unemployed parolees, parole agents judged that for 48%, their primary need for greater employability was more education (especially through high school), 38% had a primary need for personality adjustment and the ability to get along with other people, and only 11% were primarily unemployed because of a lack of opportunity. In fact, another study found that job retention was more of a problem than job acquisition. "Availability of employment opportunities was found to present fewer barriers than those caused by personality and behavioral traits, which usually led to an early discarding of the opportunities offered."[55] Unfortunately, the study did not take account of earnings offered parolees relative to the general wage level in the area.

Another study by the California Department of the Youth Authority[59] in 1962 found that only 34% of the California Youth Authority parolees were employed full-time. They also found that whereas 51% of the people in California over 25 years old in 1960 had at least 12 years of schooling, only 15% of the parolees over 21 had advanced to the 12th grade (with some of these not completing that grade). A marked secular downtrend in employment among California Youth Authority parolees from 1948 to 1962 was attributed to three main factors: (1) a higher rate of parolees with a lower level of educational achievement, coupled with increasing competition in the labor market, as seen in the overall increase in unemployment; (2) an increasing proportion of Negroes among parolees; and (3) a falling median age of male parolees. During that period, the California Youth Authority parolee caseload went from 3,104 in 1948 to 10,962 in 1962. A 1963 estimate for juvenile probation costs was $20 per month per parolee.[13] If we use that figure, the 1962 probation cost would be approximately $2.6 million.

The cost for juvenile arrests in California in 1963 was estimated to be $22 per arrest.[13] Since there were 198,528 total arrests of males for delinquency in California during 1963, the cost of those arrests is approximately $4.4 million.*

In 1965, 37,715 juvenile court cases were disposed of through judicial process.[45] With a 1963 estimated cost of $326 per juvenile court hearing,[13] these judicially disposed cases cost almost $12.3 million. Also, in 1965, the average daily population of juvenile halls in California was 3,600.[21] With a 1963 estimated daily cost of $20.48 per juvenile detained,[13] the total yearly cost would be about $26.9 million.

Finally, the five public institutions for delinquent males in California spent a total of $13.4 million in 1964. These five institutions had an average daily population of 3,371 boys for the year.[94]

From this summary for California, using mainly the most direct public costs, we get an annual estimate of $60.5 million for these components of delinquency costs. This figure is meant to indicate only the general magnitude of the total cost that we can expect to find for a specific year, rather than to indicate the public cost of delinquency in California.†

Future Empirical Work To Be Done

For a large metropolitan city in the West, we have available detailed crime data on juveniles for the years 1964, 1965, and 1966. For those three years, approximately 30,000 records are available on juveniles. We are also in the process of obtaining, for that same city, the relevant results of a special 3% sample survey (3% random sample of the entire city population) conducted in the spring of 1966. The survey was designed using the same framework as the U.S. Census of Population and Housing. Data similar to data obtained from the U.S. Census will therefore be available. We also have hopes of obtaining school data, including test scores (achievement, IQ, reading), along with grade and age to determine level of retardation. It is not certain that we will be able to obtain the school data. In any case, the crime data and the survey data will be matched by name. According to the sample taken and the number of cards available on juvenile delinquents, we should be able to get several hundred juvenile delinquents matched with the survey data. Use of these data will enable us to obtain a much more reliable determination of the incidence of juvenile delinquency. If the school data are made availabe, we will then have more meaningful educational variables against which we can analyze delinquent behavior.

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* Reference 21, 1963 edition.

† Estimates for a given year are often the products of cost and quantity estimates for different years.

Further analysis will be undertaken with the 1960 Oakland data on juvenile delinquents. The analysis will include a matrix consisting of the census tract of a delinquent's residence related to the census tract of occurrence of the crime. This will be done by level of seriousness and type of crime. The analysis will be important for the cost of delinquency, since costs may be affected if some types of crimes are generally committed outside the delinquent's tract of residence.

As of now, not very much has been done to get actual values for the cost of delinquency. Using the framework suggested in the preceding section, we will attempt to obtain dollar estimates of the relevant variables affecting delinquency costs. As a start, data for the State of California will be used. Later, if data for other states are available and if project funds permit, the pilot study for California will be expanded to other areas or to the entire United States.

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VI EVALUATION OF BENEFITS FROM TITLE I, ESEA

Introduction

In the final report, this section will contain estimates of net benefits and cost-benefit ratios for the Title I program. These will be obtained, either for Title I as a whole, or for representative school districts, depending upon the nature of the Title I data made available by the USOE and participating school districts. To demonstrate how the model derived in Chapter I will be used to estimate net benefits from Title I, an outline of a first year program conducted by a large city in the west is presented below, along with a detailed statement of how the model will be applied in this case to estimate benefits.

A Case Study of Benefits under Title I, ESEA

The city investigated as a case study has public school enrollment of over 60,000 students, approximately one-sixth of whom are in schools receiving funds under Title I. The schools in the program are all located in areas of the city with high proportions of Negro families, most of whom have low incomes. The percent nonwhite in the schools range from 50% to almost 100%, and in 1959 more than 20% of the families in the attendance areas of these schools had incomes less than $2,000, as against an average of 8% of families for the entire city. The Title I program comprised six projects, listed below with the percent of Title I funds expended on each project:

Project	Description	Percent of Title I Funds
I	A remedial and corrective program aimed at raising reading and language achievement levels	65%
II	Provision of supportive and auxiliary services in target schools, mainly to provide additional librarians, health services, guidance counseling, and teacher aids	10
III	A summer school program to raise general academic achievement; additional library facilities	14 3
IV	An augmented kindergarten and preschool program	2
V	A cultural enrichment program, including trips, etc.	2
VI	An inservice training program	5

To evaluate expected benefits from the Program, we will use the following four-part method of approach.

1. Measurement of Achievement

The direct effects of the program in raising reading and language achievement levels will be measured for the pupils in the program by comparing changes in achievement test scores over the period of the program with expected changes, where expected changes are assumed to be governed by the pre-test level of achievement; i.e.,

$$T_i^b / T_n^b \times m + T_i^b = T_i^{ea}$$

$$T_i^a - T_i^{ea} = \text{Change due to Title I}$$

where

T is test score result

i is a Title I school

b is the pre-program test

a is the after program test

ea is the expected after program test score

n is the average result for all pupils in the school attended by the i^{th} pupil, and

m is the elapsed time in months for operation of the Title I program

Comparison will be made on a school-by-school basis on the premise that the individual school represents a more homogeneous population than all schools in the project, at least in terms of socioeconomic background of the pupils.

2. Computation of Direct Benefits

The improved achievement, in months, will be transformed into the average percent of year gained, and the direct benefits will be computed by finding the present value of one year of extra schooling, and multiplying by the percent gain.*

3. Calculation of Additional Individual Benefits

Additional individual benefits in terms of changed probabilities will also be calculated. The following will be analyzed: benefits from increased probability of graduating from high school; benefits from the option of attending college, for those who graduate high school; benefits from decreased likelihood of being arrested for committing juvenile crimes; and intergeneration benefits. The procedures for incorporating these benefits in the analysis are described briefly below.†

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* This procedure was used recently by Thomas Ribich (217).

† The Ribich analysis stops with calculation of the direct benefits described in Step 2 above.

Probability of Graduating High School. The change in probability of graduating high school will be estimated by the use of a curvilinear function relating probability of graduation to years of retardation in school achievement. (See Figure 2 for an example of such a curve.)* According to this figure, reducing grade retardation by one tenth of a year will increase the probability of graduating by between 1 and 3%, with the highest percent change associated with the smallest degree of pre-Title I retardation.

The benefits will be estimated by multiplying the expected change in probability of graduation times the income difference expected because of graduation, less the additional costs of obtaining a high school education. (See Equation 8 in cost-benefit model, Chapter I.)

Option for College. The second set of indirect benefits to Title I is the value of the option to go to college, created for the new high school graduates. Figures 3 and 4 relate the probability of going to college to ability levels for each of four socioeconomic groups of the population. According to this figure, for a high school graduate of average ability from the low socioeconomic group, about 18% of the males and 13% of the females can be expected to go to college. Estimates will further be made of the probability of a person of this socioeconomic group completing college. The benefits of acquiring some college, and of completing college, for those likely to do so, will be calculated on the basis of differences in lifetime expected earnings for persons with college degrees and some college over the earnings of those with only high school diplomas. The benefits of the college option will be calculated by reference to Equation 9.

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* Figure has been derived from data on actual grade retardation. For the final report, the curve will be based on relationships between achievement test scores and graduation, derived from Project Talent data and data provided from the files of the San Diego Public School System.

FIGURE 2

PROBABILITY OF HIGH SCHOOL GRADUATION

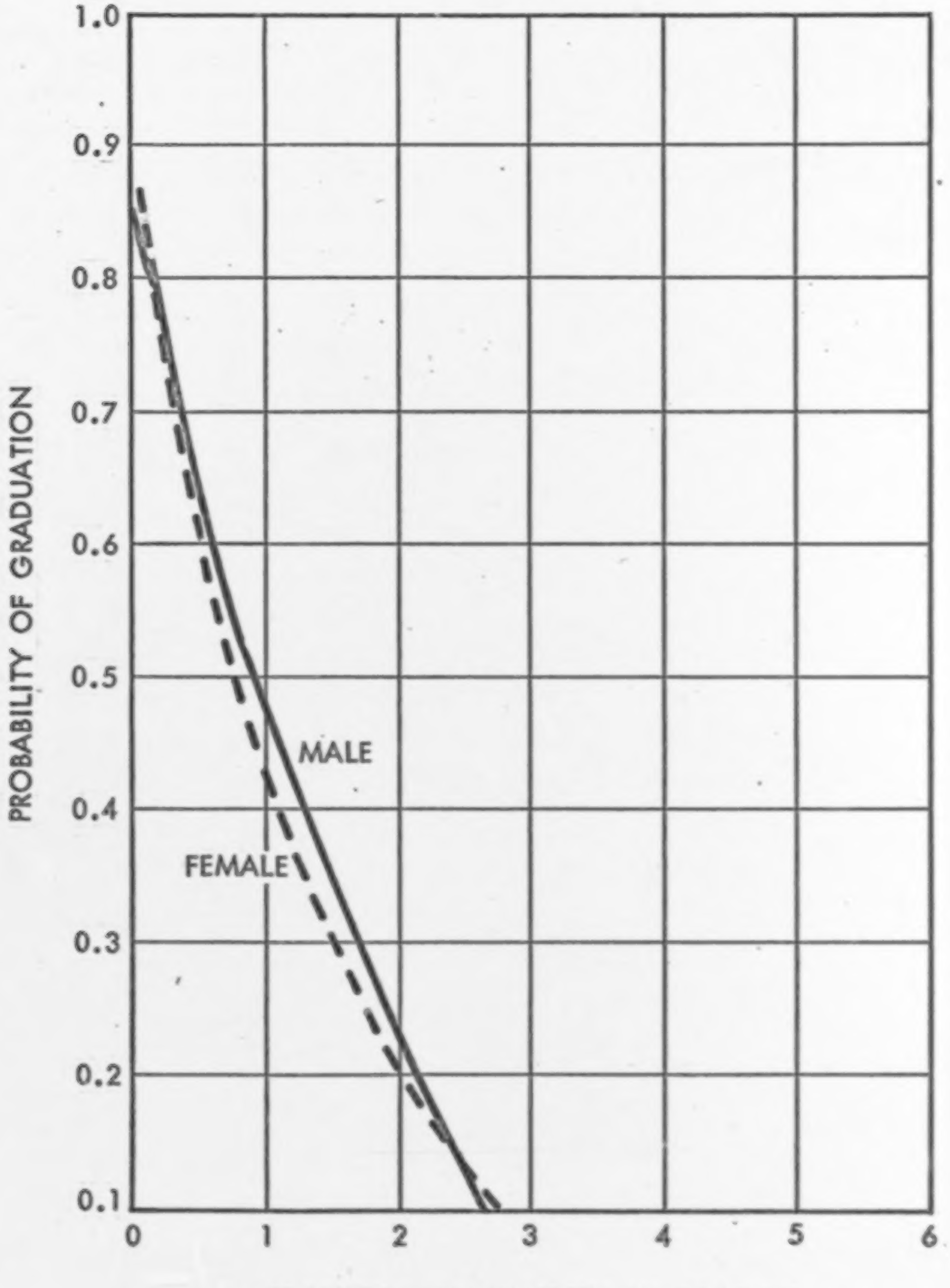


FIGURE 3

PROBABILITY OF ENTERING COLLEGE - MALE

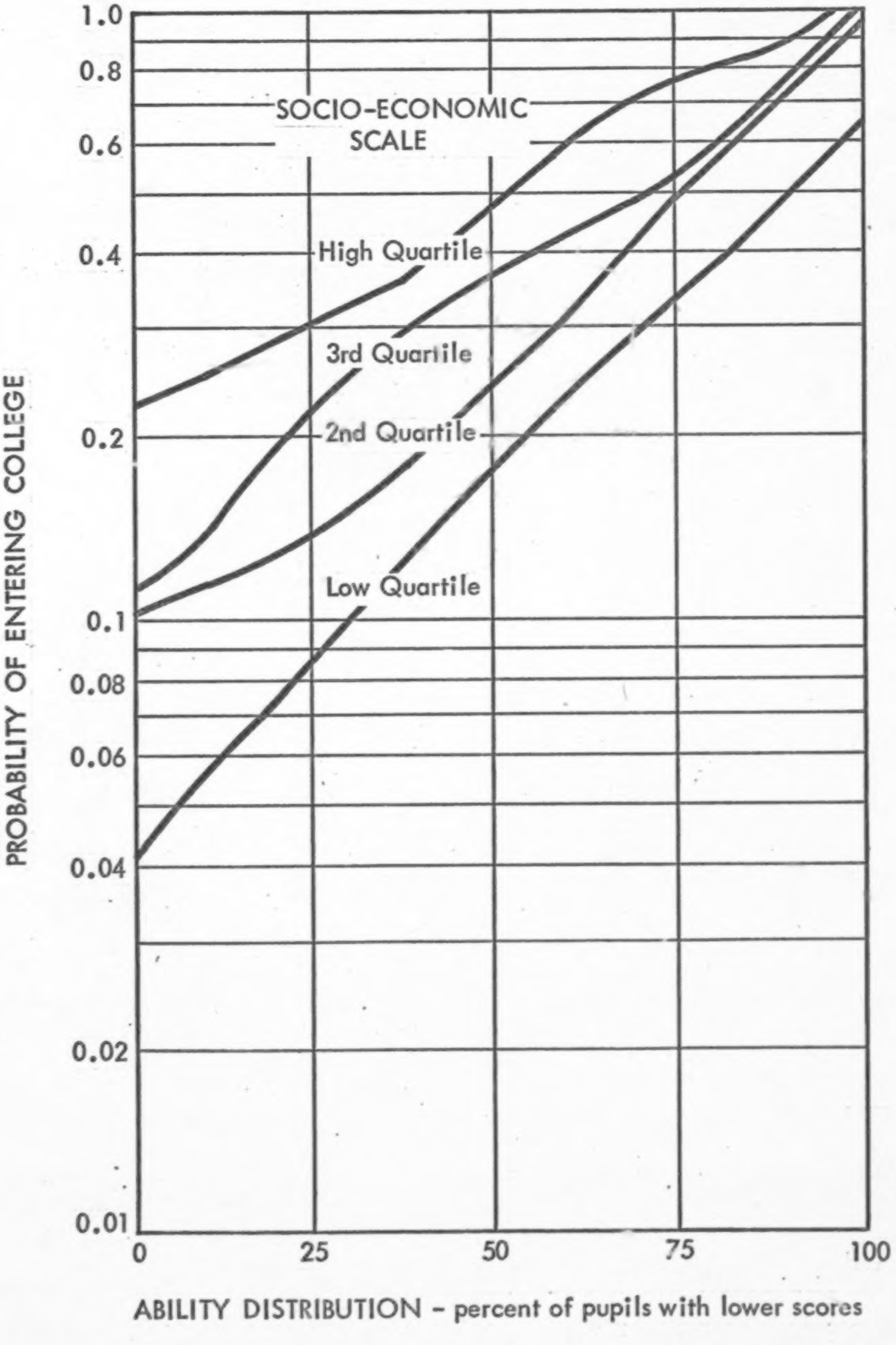
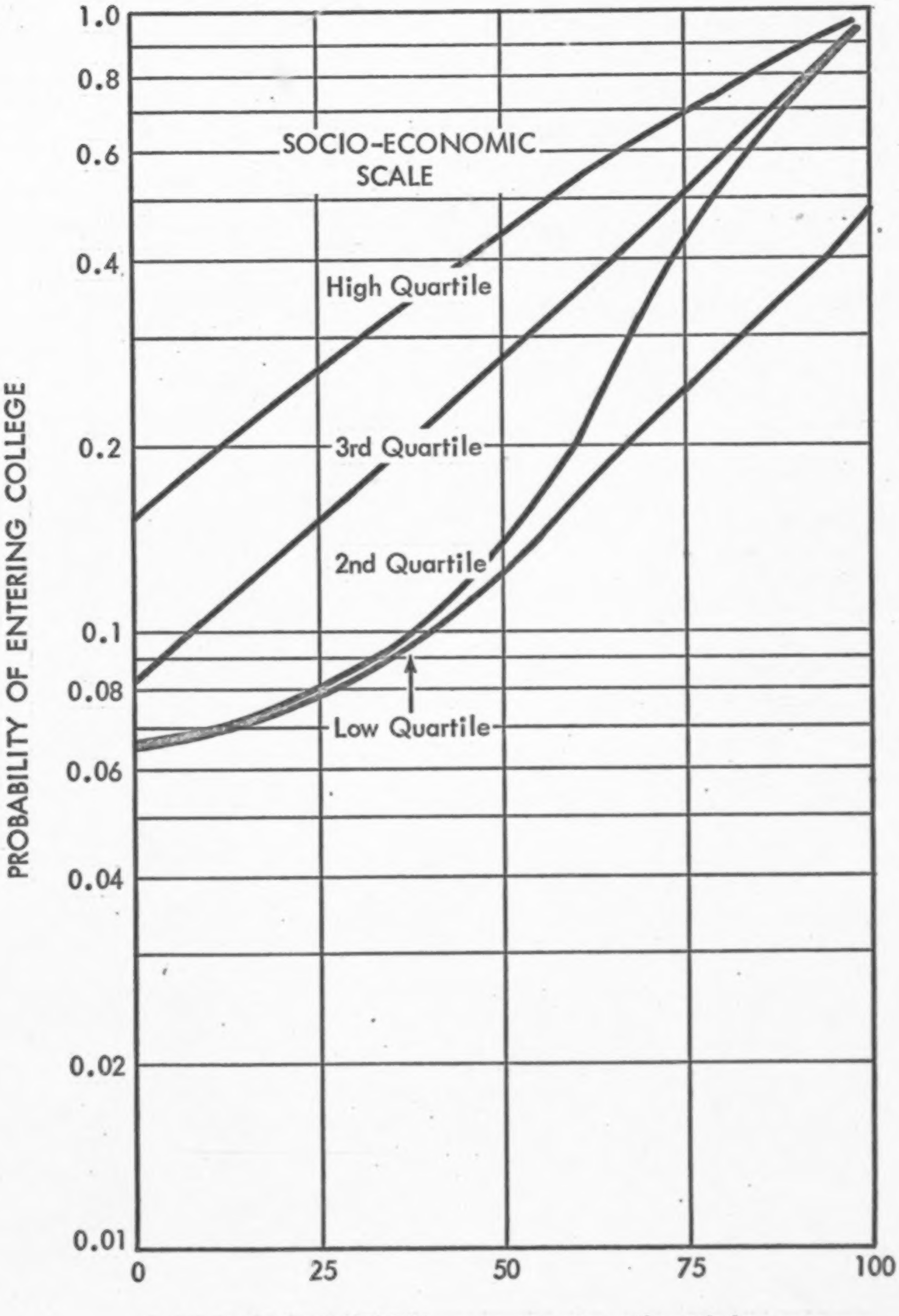


FIGURE 4

PROBABILITY OF ENTERING COLLEGE - FEMALE



Reduction in Probability of Arrest. Estimates of the parameters of Equation 5 in the model, i.e., the reduction in probability of being arrested for a juvenile crime due to being a high school graduate, will be made by use of a sample survey conducted recently in the case study city. These changes in probability will be used to estimate social and personal benefits from reduced juvenile crime, represented by Equation 12 in the model.

Intergeneration Benefits. The intergeneration benefits refer to the benefits from education that will accrue to the children of the generation currently being educated with the help of Title I. Table 57 shows that changing a drop-out to a high school graduate can be expected to increase the next generation's education by about one year. Thus, a 2% increase in probability of being a graduate is equivalent to .02 x one year, increase in the next generation's education. The benefits to the present generation of this additional education will be measured according to Equation 18, assuming that we can quantify λ, the measure of how the present generation views additional income for the future generation.

4. Comparison of Total Benefits and Cost

The sum of the benefits will then be compared with the cost of the program on a total and per pupil basis. The costs of the first year program for the case study city have been estimated to be $143 per elementary school pupil (for 6,754 pupils), $133 per junior high school pupil (for 2,489 pupils), and $123 per high school pupil (for 320 pupils).

The above estimates of per pupil costs were found by taking the total funds expended in the program (deducting from funds received, the amounts not expended by the end of August) for those projects relevant to pupil performance in the first year--i.e., Project I, including 1/15 of the capital costs (representing the expenditures in 1/3 of a year for temporary facilities designed to last about 5 years); Project II; Project III, funds for library facilities only; and Project V. Thus, funds for summer school, preschool, kindergarten, and inservice training were excluded on the grounds that these could not be assumed to affect achievement in the test period.

Table 57

AVERAGE COMPLETED EDUCATION OF CHILDREN: DEVIATIONS FOR EDUCATION (FOR SPENDING UNIT HEADS WHO HAVE CHILDREN FINISHED WITH SCHOOL)

Education of Spending Unit Heads	Number of Spending Unit Heads	Unadjusted Deviations*	Adjusted Deviations*
None	26	-2.68	-1.60
1-8 grades	478	-0.96	-0.68
9-11 grades	177	0.19	-0.12
12 grades	92	0.99	0.98
12 grades and nonacademic training	50	0.94	0.65
College, no degree	65	2.08	1.65
College, bachelor's degree	35	2.88	1.89
College, advanced degree	16	3.90	3.06

Source: Reference 100, Table 25-2, p. 374.

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* Deviations from grand mean of 11.82 grades.

Appendix A

PROJECTION OF LABOR FORCE AND JOB OPPORTUNITIES

Jop Opportunity Projections (Demand)

The projections of occupational requirements were derived as follows:

1. A projection of total employment was made by the BLS based upon Census projections of total population and BLS projections of labor force participation rates for each age-sex group.[50] In general, labor force participation rates for men age 25-59 were projected to remain constant at the 1955-57 level. For persons under 25, rates were projected separately for those in school and for those out of school--The 1955-57 level was used for those not in school, while a continuation of the downward trend was assumed for those in school. For women, separate projections were made for those with and without children and for those with and without husbands, and in each case the past upward trends in labor force participation of these groups continued. For older workers the declining trend in the rate since 1948 was assumed to continue, but at a reduced rate of decline. It was further assumed by the BLS that the level of unemployment would have no effect on labor force participation rates; that the size of the armed forces would remain at 2.7 million; and that the trend toward increased school attendance beyond high school would continue. Total employment was based upon an assumption that unemployment would be 3% and that GNP would increase 50% in real terms between 1960 and 1970.

2. Total employment was allocated to nine industry groups on the basis of historical relations to GNP, or to a major component of GNP, such as personal consumption.[1,42] Generally these projections were based on relationships between employment in an industry group and total nonagricultural employment. For some industry groups, the BLS employed multiple

regression, adding variables for unemployment, size of the armed forces, personal income, etc., to take cyclical and other factors into account.[42]

3. Employment projections by occupation were derived by the BLS from industry projections.[42] An occupation-industry matrix for 150 industry sectors was used. Occupational composition patterns for 1960 were first applied to the industry projections for 1970 and 1975; these estimates were adjusted for occupation trends within industries, including consideration of technological change, expected growth in R&D, and in some cases by the expected supply of workers.[42]

4. Occupational requirements of industry were projected by sex and level of education according to the distribution reported in March 1965,[36] see Tables A-1 and A-2, incorporating certain changes that reflect recent trends toward higher educational requirements within some occupation categories.[33,36] Educational requirements were then summed across occupational categories for males and females separately, resulting in projections of employment opportunities by level of education. See Tables A-3 and A-4.

Labor Force Projection (Supply)

Projections of the labor force by educational attainment for persons 25 years and older were made as follows:

1. Projections of total population and educational attainment were those of the Bureau of the Census.[14]

2. Members of the armed forces were removed from the projections on the assumption that their distribution of educational attainment within an age group was the same as for the population as a whole. The total armed forces of 2.7 million, distributed by age groups according to the present distribution, were determined as the difference between the total labor force and the civilian labor force.[49]

Table A-1

OCCUPATION OF EMPLOYED PERSONS 18 YEARS OLD AND OVER, BY SEX AND YEARS OF SCHOOL COMPLETED--MALE

March 1965

Occupation	Thousands of Persons	Total %	Years 0-8	9-11	12	13-15	16	17+
Professional, technical and kindred workers	5,624	100.0%	2.1%	2.9%	17.9%	16.3%	27.2%	33.6%
Managers, officials, and proprietors, except farm	6,375	100.0	15.6	13.6	35.4	16.4	14.8	4.2
Clerical and kindred workers	3,188	100.0	10.1	15.5	46.5	18.8	7.8	1.4
Sales workers	2,437	100.0	9.5	13.9	38.0	23.8	12.1	2.7
Craftsmen, foremen, and kindred workers	8,332	100.0	28.3	24.2	37.9	7.5	1.5	0.5
Operatives and kindred workers	9,171	100.0	32.7	27.9	33.8	4.6	0.6	0.2
Service workers, including private household	2,962	100.0	32.5	24.5	32.3	8.5	1.4	0.7
Farmers and farm managers	2,093	100.0	55.1	13.0	25.2	4.5	1.7	0.4
Farm laborers and	878	100.0	66.8	15.4	13.8	3.6	0.5	--
Foremen		100.0	58.6	13.7	21.8	4.2	1.3	0.3
Laborers, except farm and mine	3,151	100.0	45.8	25.1	24.0	4.2	0.7	0.3
	44,210							

Table A-2

OCCUPATION OF EMPLOYED PERSONS 18 YEARS OLD AND OVER, BY SEX AND YEARS OF SCHOOL COMPLETED--FEMALE

March 1965

Occupation	Thousands of Persons	Total %	Years					
			0-8	9-11	12	13-15	16	17+
Professional, technical and kindred workers	3,430		1.4%	3.9%	30.6%	18.4%	36.0%	19.7%
Managers, officials, and proprietors, except farm	1,122		14.2	16.4	45.7	13.4	7.6	2.8
Clerical and kindred workers	7,486		4.0	11.1	65.4	15.5	3.6	0.3
Sales workers	1,707		15.5	25.5	46.9	9.4	2.1	0.5
Craftsmen, foremen, and kindred workers	278		24.4	27.3	37.1	7.9	3.2	--
Operatives and kindred workers	3,709		38.9	29.3	29.4	1.9	0.3	0.2
Private household workers,	1,626		52.5	24.3	20.5	2.0	0.4	0.3
Service workers, except	3,590		27.9	28.2	36.6	6.3	0.8	0.3
private household			35.3	27.0	31.8	5.0	0.7	0.3
Farmers, farm managers, laborers, and foremen	489		51.0	16.0	25.3	6.0	1.6	--
Laborers, except farm and mine	106		46.3	25.5	21.7	4.7	1.9	--

Table A-3

JOB OPPORTUNITIES FOR MALES IN THE LABOR FORCE, 14 YEARS OLD AND OVER BY EDUCATION LEVEL

(Millions of Persons)

1970

		Years of School Completed				
Occupation	Total	0-11	12	13-15	16	17+
Professional	6.7	.10	1.36	1.06	1.86	2.27
Managerial	6.8	1.64	2.54	1.13	1.20	.35
Clerical	3.8	0.85	1.84	0.66	0.36	0.06
Sales	3.0	0.70	1.14	0.79	0.30	0.06
Craft	9.75	4.92	3.90	0.73	0.14	0.05
Operative	9.75	5.60	3.60	0.49	0.05	-
Service	3.9	2.01	1.43	0.35	0.06	0.02
Farmers	3.3	2.36	0.72	0.14	0.05	-
Laborers	3.5	2.48	0.83	0.14	0.02	-
Total	50.4	20.66	17.36	5.49	4.04	2.81

[redacted]

1975

Professional	7.7	-	1.54	1.23	2.23	2.70
Managerial	8.0	1.52	3.08	1.32	1.64	0.44
Clerical	4.2	0.82	2.16	0.69	0.46	0.06
Sales	3.5	0.82	1.33	1.00	0.28	0.07
Craft	10.8	5.24	4.54	0.81	0.16	0.05
Operative	10.1	5.50	4.04	0.51	0.05	-
Service	4.5	2.20	1.80	0.40	0.07	0.02
Farmers	3.4	2.45	0.75	0.15	0.05	-
Laborers	3.6	2.57	0.86	0.14	0.02	-
Total	55.8	21.12	20.10	6.25	4.96	3.34

Table A-4

JOB OPPORTUNITIES FOR FEMALES IN THE LABOR FORCE, 14 YEARS OLD AND OVER BY EDUCATION LEVEL

(Millions of Persons)

1970

		Years of School Completed				
Occupation	Total	0-11	12	13-15	16	17+
Professional	4.2	0.10	1.00	0.61	1.55	0.94
Managerial	1.3	0.35	0.65	0.13	0.13	0.04
Clerical	9.3	1.12	6.37	1.49	0.33	-
Sales	2.2	0.81	1.10	0.22	0.06	0.01
Craft	0.3	0.13	0.12	0.04	0.01	-
Operative	4.1	2.66	1.33	0.08	0.02	-
Service	7.0	4.06	2.45	0.42	0.07	-
Farmers	0.5	0.34	0.13	0.03	0.01	-
Laborers	0.1	0.07	0.02	-	-	-
Total	29.0	9.64	13.17	3.02	2.18	.99

1975

Occupation	Total	0-11	12	13-15	16	17+
Professional	4.7	-	1.22	0.61	1.79	1.08
Managerial	1.4	0.34	0.73	0.13	0.17	0.04
Clerical	10.0	0.90	7.15	1.60	0.40	-
Sales	2.4	0.82	1.27	0.24	0.06	0.01
Craft	0.4	0.15	0.17	0.06	0.02	-
Operative	4.1	2.54	1.46	0.08	0.02	-
Service	8.0	4.32	3.12	0.48	0.08	-
Farmers	0.5	0.34	0.13	0.03	0.01	-
Laborers	0.1	0.07	0.02	-	-	-
Total	31.6	9.48	15.27	3.23	2.55	1.13

3. Labor force participation rates by age, sex, and education were projected to be the same as in 1965, with some exceptions.[36] The exceptions were that rates for all females were projected to increase slightly, and that rates for males 65 years and over were projected to decline.[50] See Tables A-5 to A-8.

Projections of the labor force by level of educational attainment for persons 14 to 24 were made as follows:

1. Three points in the historical trend--1958-59, 1961-62, and 1964-65--were used to analyze school enrollment and educational attainment characteristics for this age group, subdivided into three groups: 14-17, 18-19, and 20-24. School enrollment estimates were made by the Bureau of the Census for October of each school year.[18,20,23] Those enrolled in college were distributed to attainment levels of grade 12 and above, according to the distribution reported for 1960.[6]

   The educational attainment of the civilian population not enrolled in school was taken as the difference between the educational attainment of the total civilian population in the age group.[7,8,9] and the attainment of those enrolled in school.[18,20,23] For age groups 18-24, these were checked against data on the educational attainment of civilian persons in and out of the labor force.[33,36]

2. Projections of total population by age group were those of the Bureau of the Census.[16,17]

   Projections of school enrollment were those of the Bureau of the Census using Series B-1 for the 14-17 group, which continued enrollment trends; and Series B-2 for the 18-24 age group, which averaged present levels with trend projections.[15] The attainment of nonenrolled males was projected as a continuation of the absolute numbers of high school dropouts and trended proportions of total population

Table A-5

EDUCATION AND LABOR FORCE - MALES
1970
(All Figures in Thousands)

Age Group	Total Civilian Population	Total Labor Force	0-11		12		13-15		16		17+	
			Population	Labor Force	Population	Labor Force	Population	Labor Force	Population	Labor Force	Population	Labor Force
14-17	7,957		7,698	1,955	259	114						
18-19	3,150		1,000	670	1,720	865	400	108				
20-24	7,810		1,570	1,457	3,320	3,036	2,220	1,319	515	441	175	111
25-29	6,540		2,270	2,201	2,086	2,048	851	814	771	755	562	519
30-34	5,370		2,020	1,969	1,530	1,512	639	616	667	657	514	478
35-39	5,260		2,122	2,021	1,594	1,568	628	616	518	514	398	393
40-44	5,620		2,620	2,487	1,576	1,548	600	588	456	452	368	363
45-49	5,820		2,749	2,582	1,725	1,672	588	574	402	394	356	353
50-54	5,344		2,825	2,662	1,485	1,443	500	490	274	269	260	258
55-59	4,789		2,928	2,421	1,053	948	396	359	205	192	207	194
60-64	3,957		2,669	2,200	657	591	308	279	164	154	159	149
65 and over	8,388		6,528	1,031	871	138	507	80	268	42	214	34
Total-all ages	70,005	51,950	37,940	23,656	16,663	15,729	8,240	5,843	4,124	3,820	3,038	2,852

Sources: U.S. Dept. of Commerce, Bureau of the Census, Current Population Report, Population Estimates, series P-25 No.286, July 1964; No. 329, March 10, 1966; No. 305, April 14, 1965. U.S. Dept. of Labor, Bureau of Labor Statistics, Educational Attainment of Workers, Special Labor Force Report No. 65, March 1965.

Table A-6

EDUCATION AND LABOR FORCE – FEMALES
1975
(All Figures in Thousands)

Age Group	Total Civilian Population	Total Labor Force	0-11		12		13-15		16		17+	
			Popu-lation	Labor Force	Popu-lation	Labor Force	Popu-lation	Labor Force	Popu-lation	Labor Force	Popu-lation	Labor Force
14-17	8,210		8,061	1,403	149	21						
18-19	4,062		1,081	436	2,442	1,303	539	198				
20-24	9,558		2,412	745	4,309	2,840	2,248	892	589	492		60
25-29	8,692		2,434	881	4,067	1,554	1,208	470	817	410	116	105
30-34	7,003		2,219	802	3,095	1,182	896	349	659	331	134	85
35-39	5,789		2,008	975	2,466	1,219	707	296	528	281	80	63
40-44	5,587		2,139	1,039	2,376	1,175	609	256	359	192	104	82
45-49	6,008		2,524	1,322	2,418	1,401	629	421	327	219	110	105
50-54	6,177		2,684	1,400	2,476	1,435	631	423	275	184	111	106
55-59	5,578		2,805	1,111	1,913	953	513	258	238	162	109	92
60-64	4,986		2,877	1,126	1,350	673	452	226	201	138	106	90
65 and over	12,250		8,532	634	2,070	238	1,012	123	418	71	218	70
Total-all ages	83,900	33,159	39,776	11,874	29,131	14,085	9,444	3,912	4,411	2,480	1,138	858

Table A-7

EDUCATION AND LABOR FORCE - FEMALES
1970
(All Figures in Thousands)

Age Group	Total Civilian Population	Total Labor Force	0-11		12		13-15		16		17+	
			Popu-lation	Labor Force	Popu-lation	Labor Force	Popu-lation	Labor Force	Popu-lation	Labor Force	Popu-lation	Labor Force
14-17	7,718		7,579	1,424	139							
18-19	3,611		961	427	2,171	1,289	479	197				
20-24	8,551		2,158	702	3,856	2,332	2,010	791	527	437		50
25-29	6,943		2,201	795	3,083	1,178	910	354	632	317	117	74
30-34	5,763		2,001	721	2,454	937	703	273	526	264	79	50
35-39	5,597		2,142	1,008	2,382	1,141	611	249	359	186	103	79
40-44	6,075		2,552	1,199	2,446	1,172	636	258	330	171	111	85
45-49	6,304		2,740	1,390	2,562	1,461	644	363	280	182	114	105
50-54	5,759		2,896	1,465	1,975	1,142	530	298	246	160	112	103
55-59	5,250		3,029	1,158	1,421	692	476	232	212	142	112	92
60-64	4,494		2,824	1,070	954	464	425	208	189	126	102	85
65 and over	11,186		8,293	647	1,584	195	827	108	321	59	161	55
Total-all ages	77,251	30,162	39,376	12,006	24,991	12,003	8,251	3,331	3,622	2,044	1,011	778

Table A-8

EDUCATION AND LABOR FORCE - MALES
1975
(All Figures in Thousands)

Age Group	Total Civilian Population	Total Labor Force	0-11 Population	0-11 Labor Force	12 Population	12 Labor Force	13-15 Population	13-15 Labor Force	16 Population	16 Labor Force	17+ Population	17+ Labor Force
14-17	8,969		8,887	1,986	82	124						
18-19	3,580		1,356	651	1,586	1,328						
20-24	8,940		2,446	1,413	2,995	3,515	638	125				
25-29	8,360		2,534	2,455	2,876	2,819	3,043	1,652	456	551		144
30-34	6,670		2,314	2,259	1,995	1,972	1,154	1,103	1,053	1,030	743	686
35-39	5,470		2,058	1,960	1,558	1,531	834	802	867	854	660	614
40-44	5,210		2,103	1,999	1,578	1,553	651	637	680	672	523	515
45-49	5,570		2,595	2,448	1,561	1,517	621	610	513	509	395	389
50-54	5,663		2,675	2,523	1,680	1,633	595	583	453	445	366	363
55-59	4,974		2,630	2,181	1,382	1,244	571	560	391	384	346	344
60-64	4,293		2,624	2,169	944	850	465	421	255	239	242	227
65 and over	8,920		6,541	1,465	1,163	338	355	322	184	173	186	175
							609	223	323	110	284	135
Total-all ages	76,619	57,532	38,763	23,509	19,400	18,424	9,536	7,038	5,175	4,967	3,745	3,592

having some college or completing college. These trends were adjusted for the age group 20-24 to be consistent with the Census projections for the age group 25 to 29 five years later, Series A. This series was also used as control on attainment trends for females.

3. Labor force participation rates were those for 1965. The rates distinguished between those enrolled and those not enrolled in school,[43-45] projecting a reduction of 1% for 1970 and 2% for 1975 for those enrolled in school. For those not enrolled, the rates further distinguished between high school graduates and dropouts.[37-40]

Appendix B

RELIABILITY AND VALIDITY OF DELINQUENCY DATA

In the evaluation of any empirical study purporting to show either the factors associated with, or the incidence of, delinquency, a crucial issue that must be considered is the reliability and validity of the data used. Official statistics are said to be an inadequate indicator of the true relationship between delinquency and a host of socioeconomic indices.[72]* The problem is not that only a small sample of the total number of delinquent acts become part of the official record, but rather that there is a systematic bias in the apprehension, adjudication, and conviction pattern of delinquents.[7,15,27,31,34,66,85,89] The clear implication here is that no meaningful statistical deductions can be made about the total incidence of delinquency from an analysis of apprehended delinquents. However, very little evidence has been produced to support or refute this assertion.[47,102] Results based on self-report techniques have generally been used to show the huge gap between the volume of delinquent acts and the number of apprehended and officially recorded delinquents, and also to show the existence of delinquency among middle and upper class youths. The contention here is that these more privileged groups are not adequately represented in the official statistics because of the differential selection process by police, and by the middle and upper class youth's greater ability to avoid detection and apprehension.[22,25,27,35,39,64,71,99]

Other studies using the self-report technique have questioned these negative findings, and have asserted that the official records are fairly reliable indicators of the incidence of delinquency.[16,32,33] Moreover, it has been suggested that hidden delinquency may be as prevalent among the lower class as among the middle and upper class population.[14,47,102]

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* Reference numbers are to special juvenile delinquency bibliography following Chapter V.

There is also serious doubt regarding the reliability and the validity of self-reported information as an indicator of the incidence of "true" delinquent behavior.[40]

Within the field of official statistics, it has been found that the most reliable data to indicate the incidence of delinquency are at the point of initial police contact. The farther the data collector gets from this original source, the less reliable the data become, because at each remove, the data suffer some abstraction, consolidation, or ellipsis, as well as human translation/transmission errors. Also, inter-area comparisons are said to be especially unreliable because of reporting inconsistencies between areas. These arguments have generally been directed at the data presented in the Federal Bureau of Investigation's Uniform Crime Report.[4,101]*

Since the criticism of official statistics is that they represent a nonrandom selection from the total population of delinquents, it is impossible to statistically test whether the probability of the results being obtained by chance is high or low. But there is some indirect evidence (aside from results of some of the self-report studies) to suggest that official statistics are a fairly reliable indicator of the incidence of delinquency for given types of crimes and in given areas.

Essentially, the argument against using official data is that they represent a statistically artificial relationship because of (1) discretionary arrest procedures used by police; (2) differential density of police placement, especially when white areas are compared with nonwhite areas; (3) higher visibility of juveniles in poor neighborhoods; and (4) social and economic ability of higher status delinquents to avoid being apprehended, or if apprehended, to avoid being officially labeled as delinquents. If this criticism were valid, if the relationships found using official data were merely statistical artifacts, then use of those data would be meaningless. What we intend to show is that for the serious delinquent acts, it is very unlikely that the relationships indicated by official data are artificial, even though the precise magnitude of those relationships might be somewhat distorted. Furthermore, for the less serious acts of delinquency, there is no clear and unambiguous proof that official data present statistically artificial relationships, especially as the data concern differences in the incidence of delinquency among socioeconomic classes.

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* Reference 3, pp. 111-129.

The implication is made that if, for example, the true number of Negro and white delinquents were revealed, the ratio of the crime rate for whites to the crime rate for Negroes would be approximately 1. On the other hand, official data show that this ratio is significantly less than 1. The latter result is said to be a statistical artifact. What will now be shown is the magnitude of the difference in hidden delinquency that would have to be revealed in order for the ratio of white to Negro crime rates to approach 1.

For this example, the Oakland Police Department's records on juvenile contacts for 1960 will be used. From the total police contacts for the year, 5,566 were for males 10 through 17 years of age who resided in Oakland at the time of apprehension. The total contacts have been subdivided in several ways. First, the total was divided into a white and nonwhite category (the nonwhites are almost all Negro); then the white and nonwhite groups were split into two groups each, depending on the disposition by the police after the contact. In group A were those juveniles who were reprimanded and released or merely interviewed after being apprehended; in group B were all those who were sent along to a further and more formal level of adjudication. Of the total, 57 percent were in group A and 43 percent in group B. A final division of the previous groups was made into three classes, according to seriousness of the delinquent act for which the police contact was made. In class I were the most serious acts of robbery, burglary, grand theft, and auto theft. In class II were placed the less serious juvenile crimes including various types of petty theft, shop lifting, bicycle theft, assault and battery, and carrying dangerous weapons. In class III were the least serious crimes, those most likely to be affected by specific environmental conditions. These included drinking by minors, disturbing the peace, malicious mischief, loitering, immoral life, incorrigibility, and runaways. Class I offenses had 15% of all contacts; class II, 24%; and class III, the remaining 61%. Table 1 presents a cross classification of the police contacts by race, disposition, and class of offense.

Table B-1

TOTAL NUMBER OF MALES AGED 10-17 APPREHENDED BY OAKLAND POLICE IN 1960, BY RACE, DISPOSITION, AND SERIOUSNESS OF CRIME*

Crime Class	White Race Disposition		Nonwhite Race Disposition	
	A	B	A	B
I	62	69	49	662
II	140	414	340	421
III	1,232	1,248	286	643
Total	1,434	1,731	675	1,726

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* See text for definitions of crime class and dispositions.

From Table 1, and census data of the total number of males aged 10-17 in Oakland in 1960, by race, we can get age specific crime rates by crime class, race, and disposition. Now, the argument that says official data are a statistical artifact, and therefore useless for empirical work, was said to imply a ratio approaching 1 for white/nonwhite crime rates. Table 2 shows the Oakland ratios for the crime rates by race, disposition, and seriousness of the offense.

From Table 2 it can be seen that for the ratio of class I crimes to approach 1, from 10 to 20 times as many whites as have been reported would have to be apprehended. This means that a differential selection process, if class I crime rates by race are similar, has so strong a systematic bias that the apprehension rate for nonwhites is 10 to 20 times as great as that for whites. Other than a valid, reliable, and relevant self-report by delinquents, there is no statistical technique by which we can

Table B-2

RATIO OF WHITE TO NONWHITE CRIME RATES*
BY CLASS OF OFFENSE AND DISPOSITION

	Disposition	
Crime Class	A + B	B
I	$\frac{C_W^{I}}{C_{NW}^{I}} = \frac{9.3}{103.1} = 0.09$	$\frac{C_W^{IB}}{C_{NW}^{IB}} = \frac{4.9}{96.0} = 0.05$
II	$\frac{C_W^{II}}{C_{NW}^{II}} = \frac{39.4}{110.4} = 0.36$	$\frac{C_W^{IIB}}{C_{NW}^{IIB}} = \frac{29.5}{61.0} = 0.48$
III	$\frac{C_W^{III}}{C_{NW}^{III}} = \frac{176.8}{134.7} = 1.31$	$\frac{C_W^{IIIB}}{C_{NW}^{IIIB}} = \frac{88.9}{93.2} = 0.95$
Total	$\frac{C_W}{C_{NW}} = \frac{225.5}{348.2} = 0.65$	$\frac{C_W^{B}}{C_{NW}^{B}} = \frac{123.3}{250.2} = 0.49$

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* Crime rates are given as the rate per 1,000 males aged 10-17.

Key: C_W^I = Crime rate of Class I crimes for whites

C_{NW}^I = Cimre rate of Class I crimes for nonwhites.

C_W^{IB} = Crime rate of Class I crimes for whites with disposition B

C_{NW}^{IB} = Crime rate of Class I crimes for nonwhites with disposition B

A corresponding meaning is given for Class II, III and total.

reject this possibility, but impressionistic data (especially references 26 and 69) suggest that it is far from being true.

On the other hand, class III crimes with disposition A or B have a ratio of rates exceeding 1, and the ratio for disposition B is slightly less than 1. If the statistical artifact thesis were valid, this would imply that the less serious offenses were committed primarily by whites. Unless more substantial evidence is presented, it seems unlikely that the crime rates given for the most serious crimes have a strong racial component. Consequently, it seems reasonable to say that in the Oakland instance, the incidence of delinquent behavior as derived from official data should not be too far from the truth. In addition, the self-report results of the incidence of delinquency have been primarily concerned with the less serious crimes (or deviances); and Table 2 shows that for this class (III, disposition B), the official ratio is also close to 1. Furthermore, the results of one study based on self-reporting of deviant acts have shown that the most serious crimes, which we have included in class I, have the highest ratio of official detection to the total number of such offenses committed.*

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* Reference 27, pages 460-461.

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